BaudMaster ™

Isolated USB
to
RS-485/RS-422 Converters

1-Port: BMUSB-ID1
2-Port: BMUSB-ID2

User's Manual

Rev. 1.0 11/26/10

Innovative I/O Since 1977

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BaudMaster™

Isolated USB to RS-485/RS-422 Converter
User's Manual

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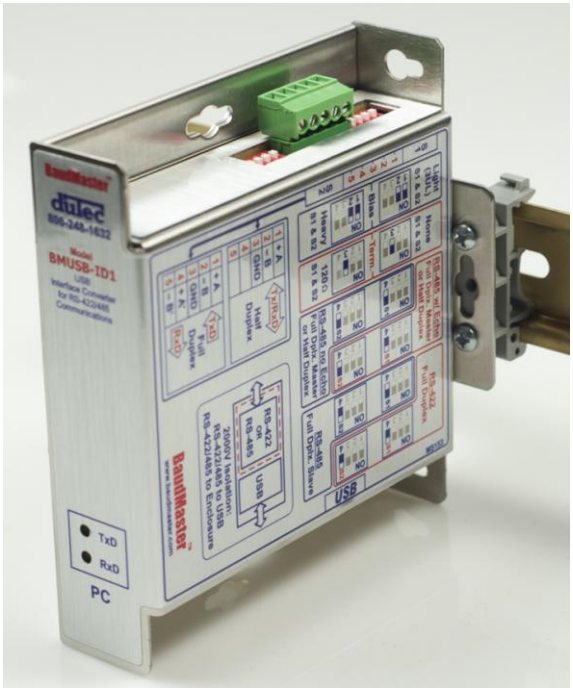
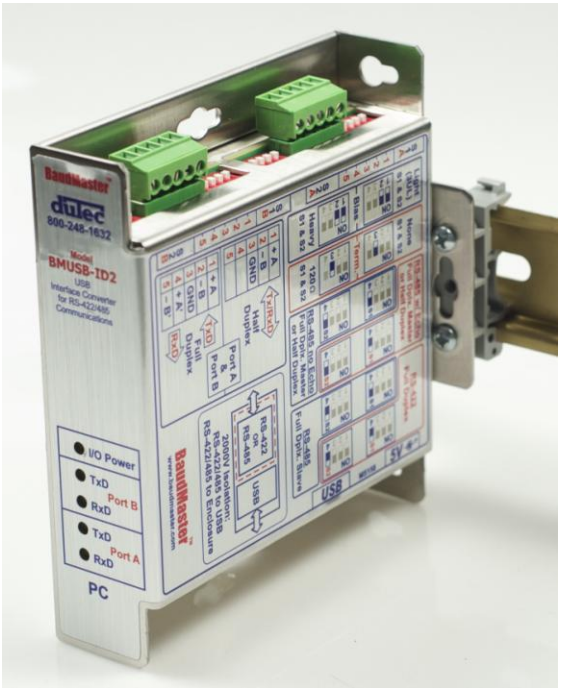
1 Introduction

The BaudMaster™ USB converters are designed to allow the connection of RS-485 and RS-422 devices to any USB equipped PC. The converters function as a USB-to-UART bridge with an isolated RS-485/422 interface. For RS-485 networks the converters automatically control the direction of serial data eliminating the need for software flow control. The isolated interface provides protection from voltage spikes and ground loops that may hamper communications or harm computer ports.

There are two software interfaces available for the converter. One interface provides a Virtual COM Port (VCP) which appears to the system as a legacy COM port. The second interface, D2XX, is provided via a proprietary DLL. The D2XX interface provides special functions that are not available in standard operating system COM port APIs. See the *Driver Installation* section for more information.



BMUSB-ID1
1-Port Converter



BMUSB-ID2
2-Port Converter

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2 Features

USB Port Powered (-ID1) No external power supply is required (USB low power device).

USB Port Powered or Self Powered (-ID2) USB high power device (> 100mA) that can be powered directly from the USB host or self-powered hub. For operation with a bus-powered hub the converter can be powered from an external 5V supply. The 5V power input is protected from over-voltage and reverse polarity connections.

Electrical Isolation Optical and transformer isolation technology provide 2000 volts of signal and ground isolation between the computer and the serial interface. Eliminates ground loops that destroy computer ports and reduce serial communications reliability.

Transient Voltage Protection 15KV ESD protection on all signal lines.

USB 2.0 Compatible USB Specification 2.0 compliant; backward compatible with USB 1.0 and 1.1

WHQL Certified Drivers Certified drivers are supplied for Microsoft Windows 7 (32-bit and 64-bit), Microsoft Windows Vista (32-bit and 64-bit), Windows XP and Windows 2000. Drivers for Windows ME, Windows 98SE, MAC OSX and Linux are also available. Contact Dutec for more information.

Virtual COM Port Windows will install the converter as an additional COM port that is compatible with existing COM Port PC applications.

Direct USB Device Support Drivers are available that provide an alternative interface solution that does not implement a COM port. A simple, high-level application program interface (API) is used to provide simpler USB-UART connectivity and functionality.

High Speed RS-485/422 Communications Support for data rates up to 921.6 kbps.

Switch Selectable Communication Modes RS-422, RS-485, 4-wire master/slave operation and echo modes can be configured with DIP switches available from the outside of the converter case. The switches are identified on the label for easy setup.

Switch Selectable Termination and Bias Resistors Network termination and bias can be configured with DIP switches available from the outside of the converter case. The switches are identified on the label for easy setup.

Data Echo With the echo feature enabled, data is echoed back to the PC's communication port. This may desirable or required with some protocols.

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Status LEDs Status LEDs are provided for transmit and receive data.

Pluggable Terminal Blocks Industrial rated pluggable terminal blocks for ease of installation or removal. Accepts up to 16 AWG wire.

High Retention USB Connector A high retention force USB connector ensures a reliable connection.

Stainless Steel Enclosure A rugged stainless steel enclosure provides protection from harsh environments.

DIN Rail Mounting DIN Rail mounting accessories available for easy wiring.

USB Cable A 2 meter A-B cable is included with the converter.

3 Driver Installation

There are two software interfaces available for the converters. One interface provides a Virtual COM Port (VCP) which appears to the system as a legacy COM port. The second interface, D2XX, is provided via a proprietary DLL. The D2XX interface provides a simple, high-level application program interface (API) that is used to provide USB-UART connectivity and functionality. For Windows, the D2XX driver and VCP driver are distributed in the same driver package, called the Combined Driver Model (CDM) package and both drivers are installed during the installation process. Applications may use either the D2XX or VCP interface but may not use both interfaces at the same time.

The CDM driver provides support for Microsoft Windows 7 (32-bit and 64-bit), Microsoft Windows Vista (32-bit and 64-bit), Windows XP and Windows 2000. Drivers for Windows ME, Windows 98SE, MAC OSX and Linux are also available. Contact Dutec for more information.

3.1 Driver Installation for Windows 7

If a Dutec converter has already been installed on the PC the new converter will automatically be installed using the existing drivers. To force the use of the new driver files the existing drivers need to be removed. Refer to the Uninstalling Devices and Drivers for Windows 7 section for more information.

- Insert the BaudMaster™ CD into the PC's CD-ROM drive. If a CD-ROM drive is unavailable the driver files can be downloaded as a self-extracting zip file from the Dutec website. Run the self-extracting zip file to unzip them to a directory on your PC (default location is C:\Dutec\BMUSB Driver).

- Plug the converter into an available USB port. The operating system (OS) will detect the new hardware and will attempt to connect to the Windows Update website to locate a suitable driver.

- If the automatic installation occurs the OS will display a message '**Device driver software was successfully installed**'. Clicking on the message opens a window that is similar to Figure 3.1.1

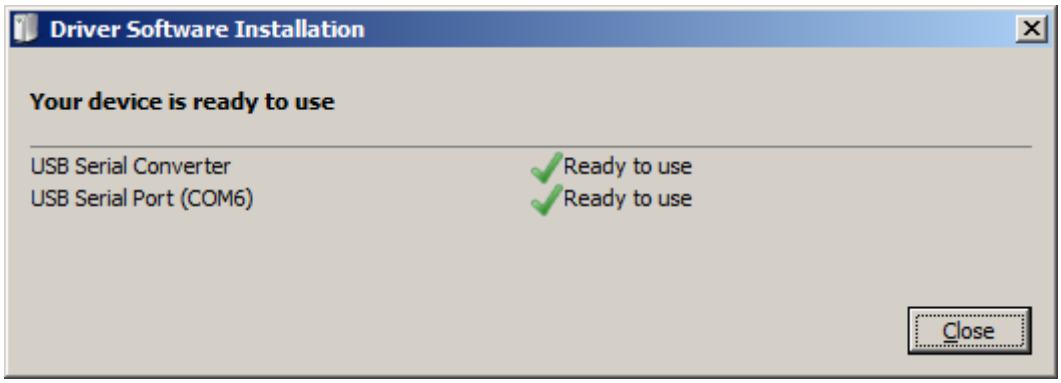


Figure 3.1.1

NOTE – Multiple devices will be listed if you are attempting to install a multiple port converter.

- Refer to the end of this section for information on completing and verifying the installation.

Installation without Windows Update (no internet connection)

- Click on the Windows 'start' button to open the start menu and select 'Control Panel'.

- From the Control Panel window select 'Hardware and Sound' (Figure 3.1.2)

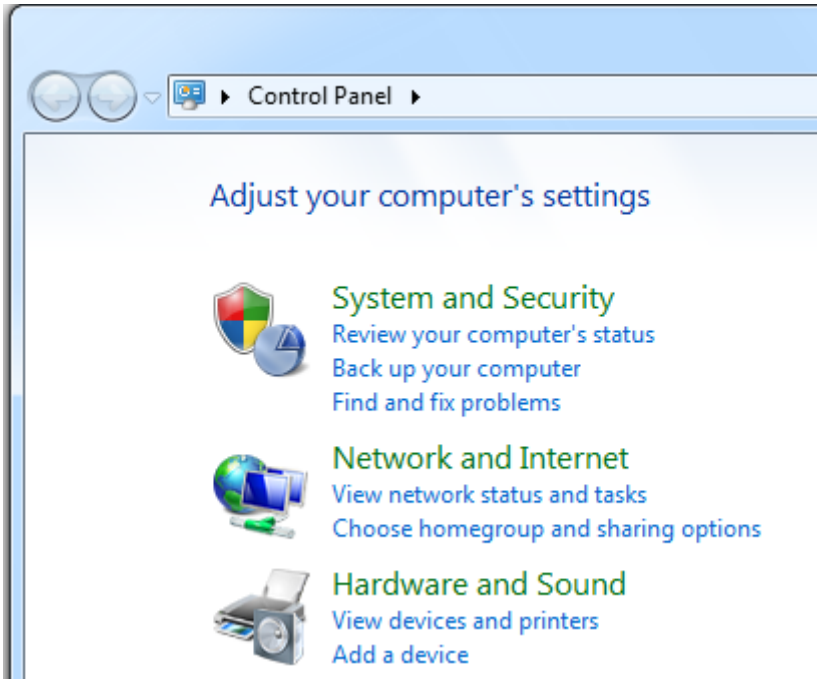


Figure 3.1.2

- Select 'Device Manager' from 'Devices and Printers' (Figure 3.1.3)

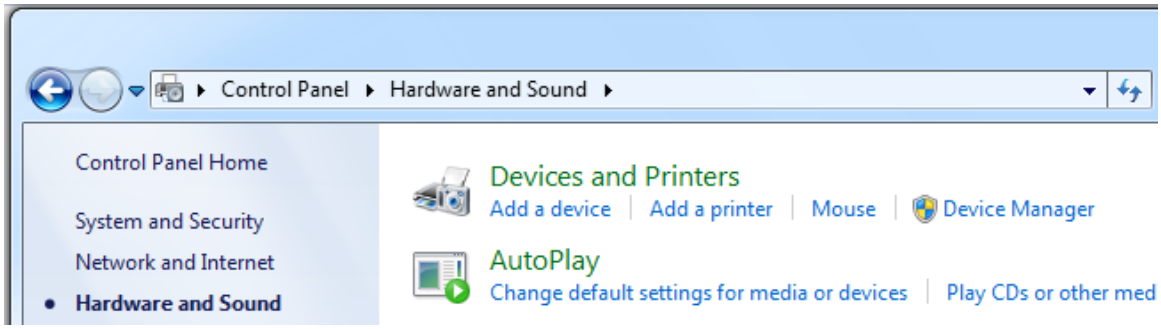


Figure 3.1.3

- In the Device Manager window the BaudMaster™ converter will appear under 'Other devices' with a yellow warning symbol to indicate that no driver is installed. (Figure 3.1.4)

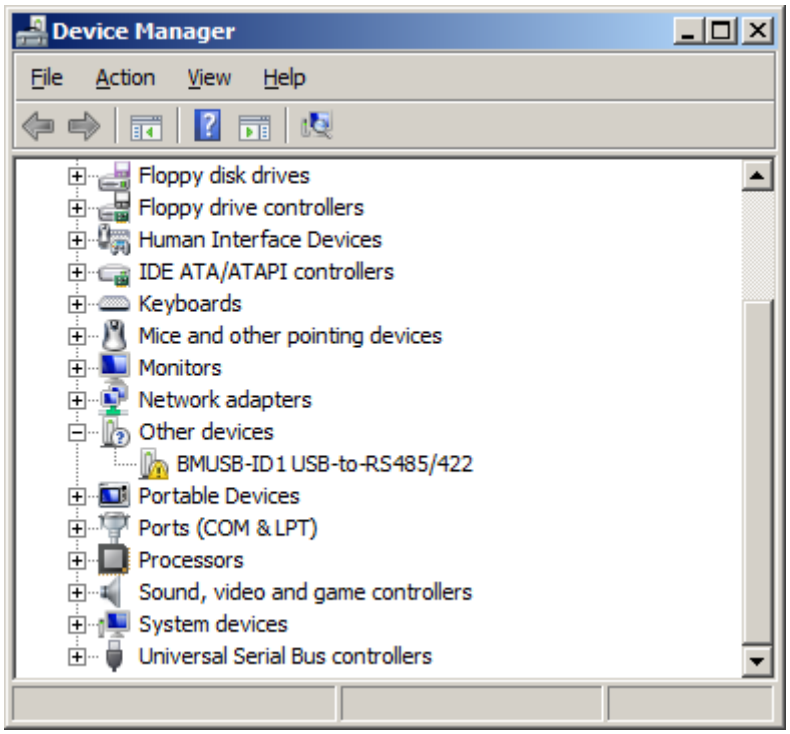


Figure 3.1.4

- Right click on the BMUSB Converter to open a menu (Figure 3.1.5) and select 'Update Driver Software'.

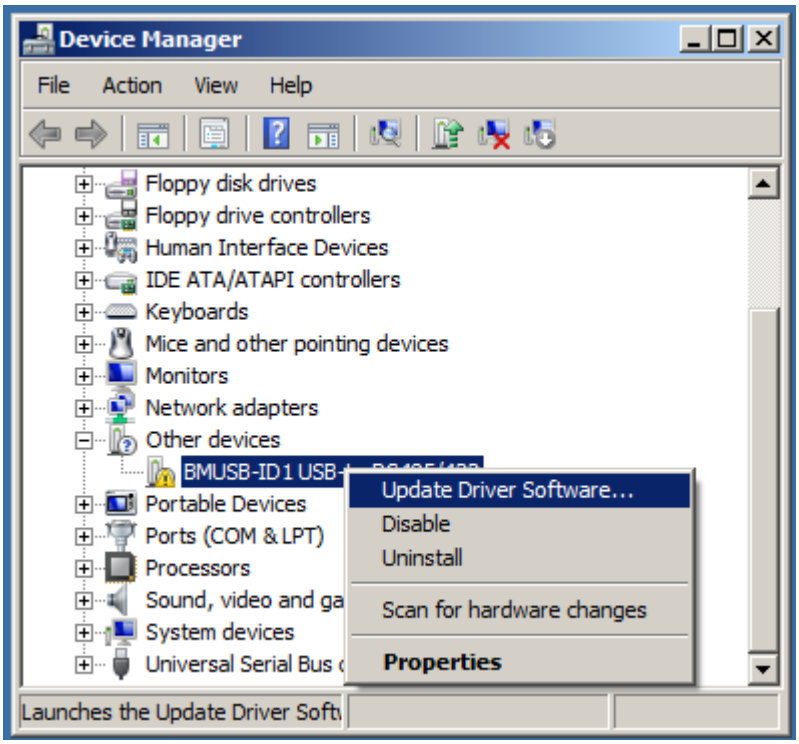


Figure 3.1.5

- At the next window select 'Browse my computer for driver software' (Figure 3.1.6)

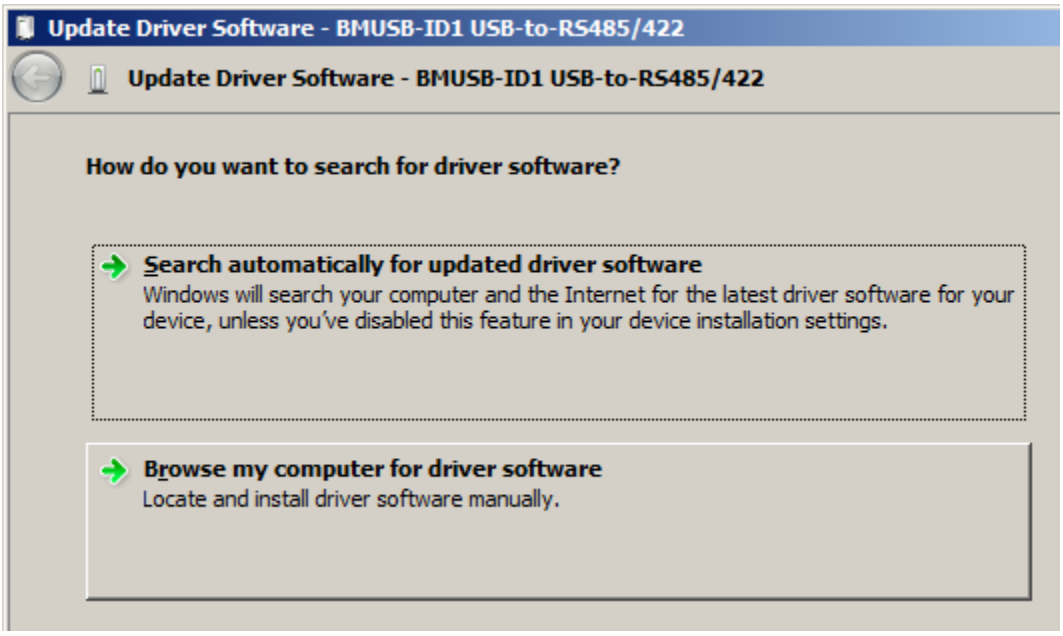


Figure 3.1.6

- Enter the driver file path in the combo-box ('D:\Dutec\BMUSB Driver' in Figure 3.1.7 below) or browse to it by clicking the browse button. The drive letter ('D:' in this example) may differ due to the PC's configuration or if selecting the folder containing the un-zipped driver files. Once the file path has been entered in the box, click 'Next' to proceed.

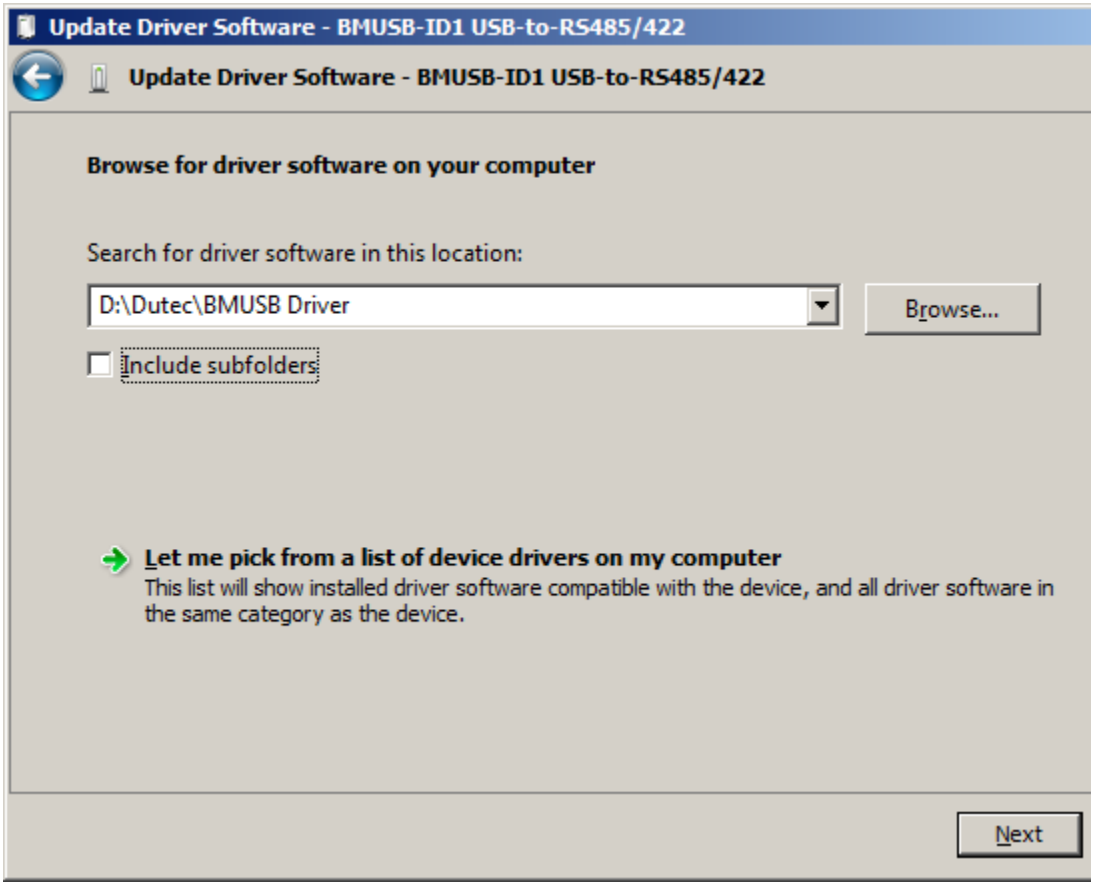


Figure 3.1.7

- The operating system will display a screen when the installation is finished (Figure 3.1.8). Click 'Close' and return to the Device Manager window.

Figure 3.1.8

- 'USB Serial Port' now appears under 'Other devices' with a yellow warning symbol to indicate that no Virtual Com Port driver is installed.

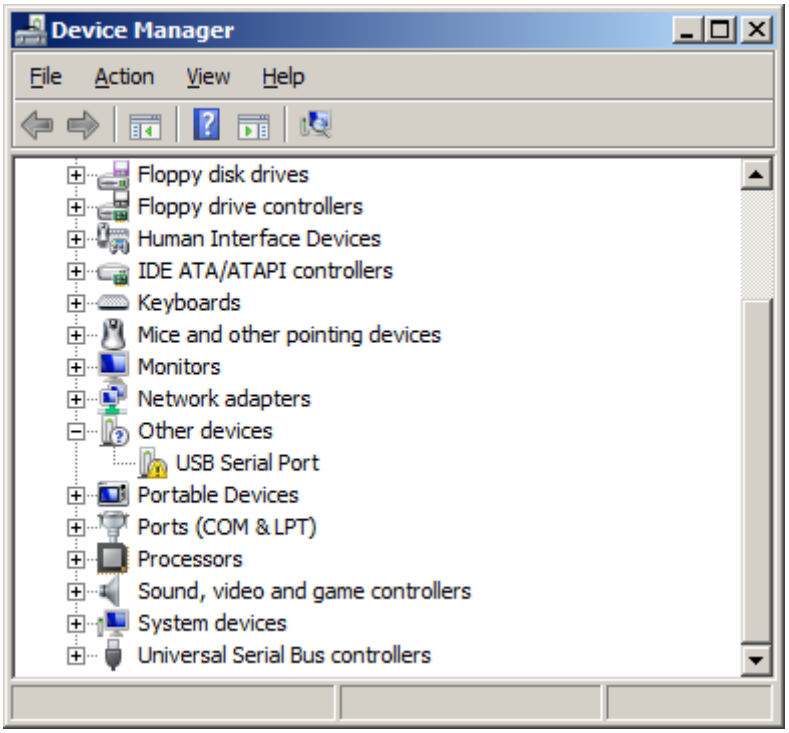


Figure 3.1.9

- Right click on the USB Serial Port to open a menu (Figure 3.1.10) and select 'Update Driver Software'.

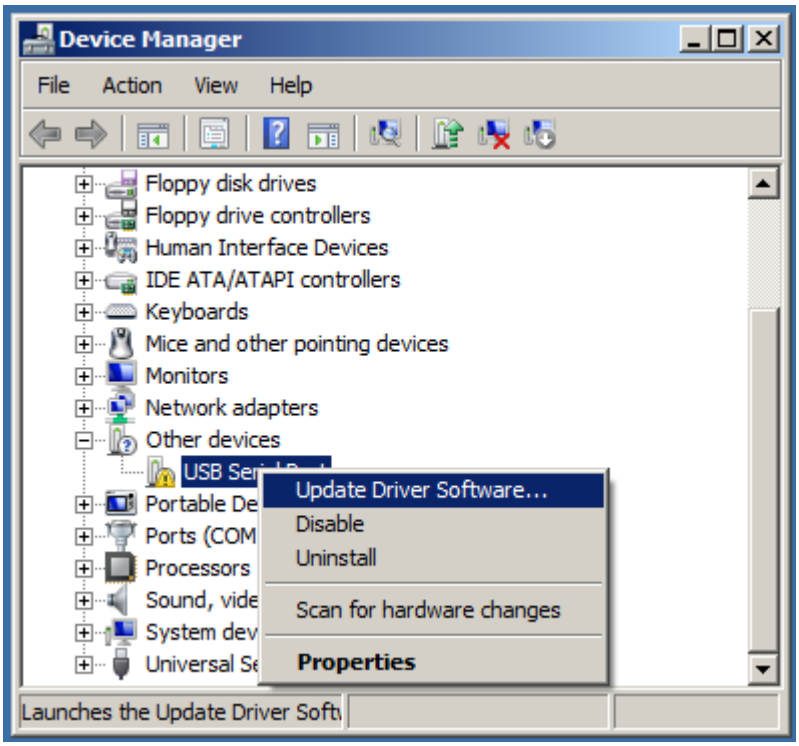


Figure 3.1.10

- At the next window select 'Browse my computer for driver software' (Figure 3.1.11)

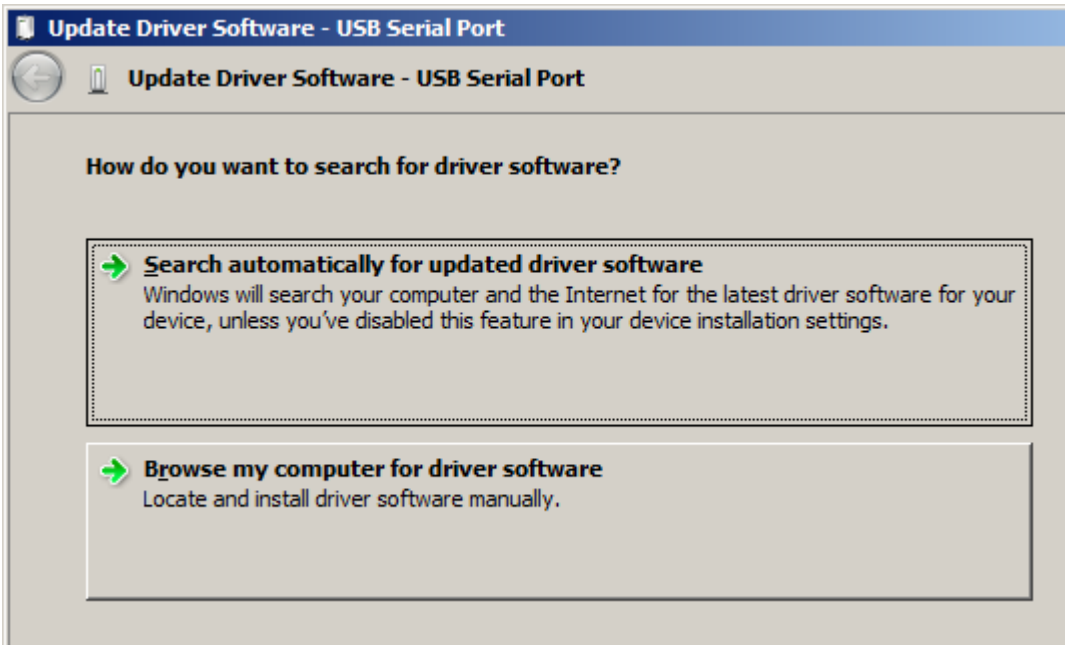


Figure 3.1.11

- Enter the driver file path in the combo-box or browse to it by clicking the browse button (Figure 3.1.12). Once the file path has been entered in the box, click 'Next' to proceed.

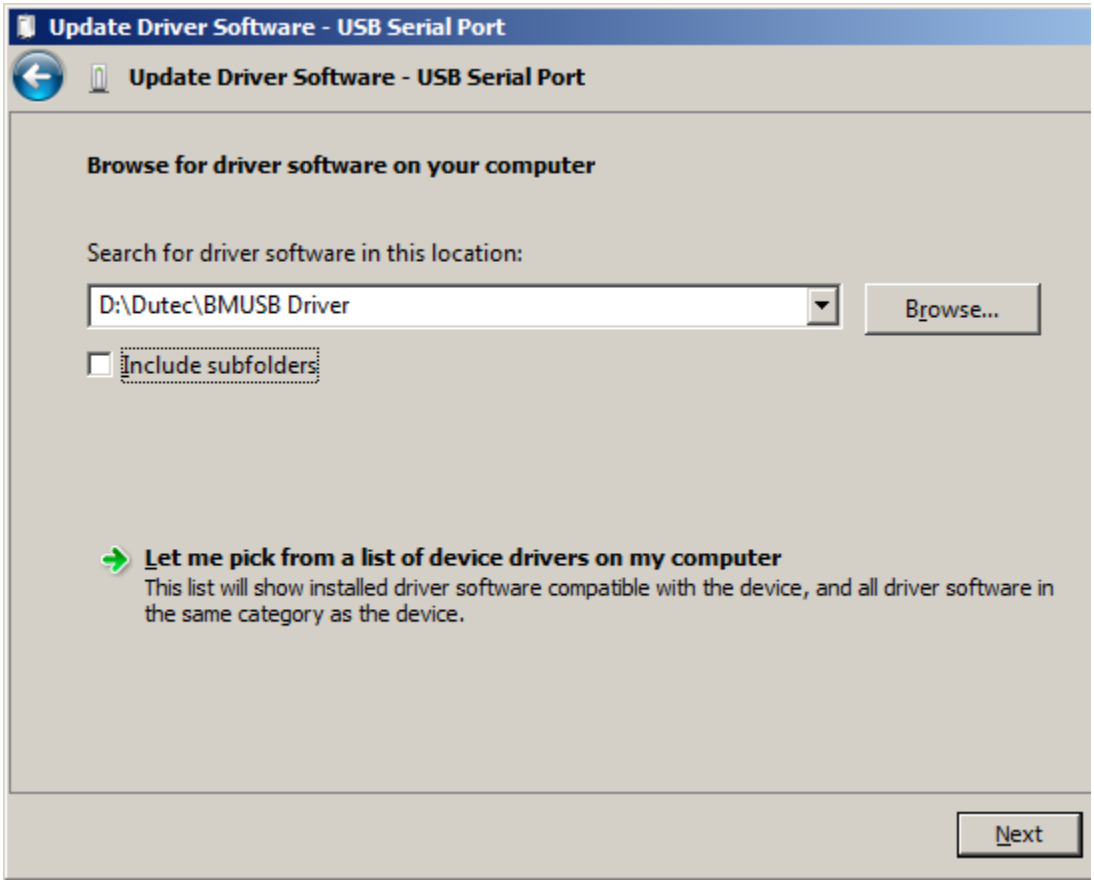


Figure 3.1.12

- The operating system will display a screen when the installation is finished (Figure 3.1.13). The COM port number may vary depending on the assignment of other existing ports. Click 'Close'.

Figure 3.1.13

- If installing a multiple port converter repeat the procedure for each additional COM port.

- After successfully completing the driver installation the converter will be assigned a communications port (Com Port) number. To find this assignment and other device information run the program *PortFinder* which is located on the installation CD.

- Click the 'Request Com Port Info' button to get information on all installed Dutec converters.

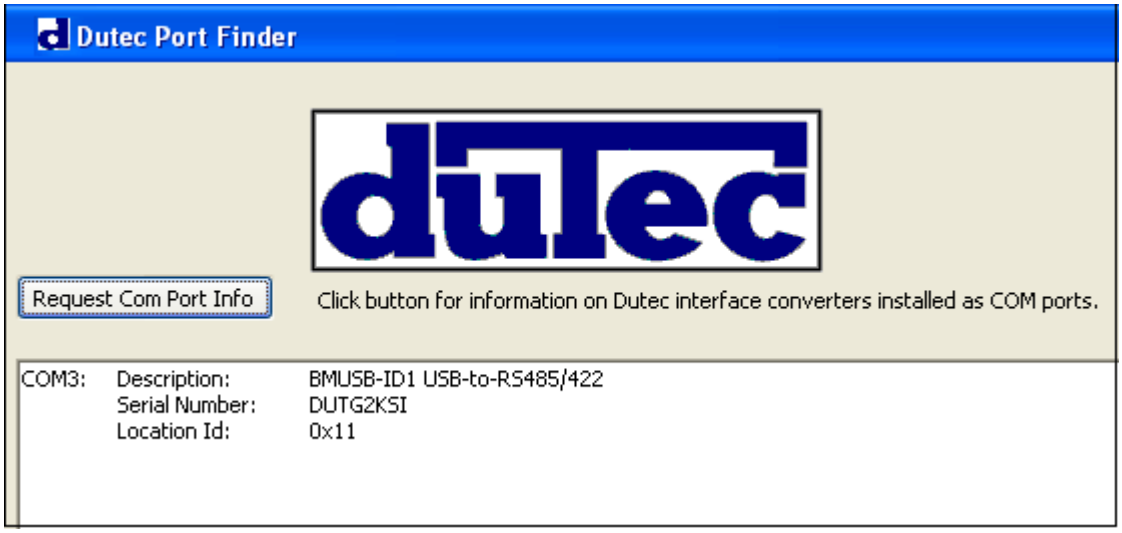


Figure 3.1.14

3.2 Uninstalling Devices and Drivers for Windows 7

Microsoft Windows 7 will only allow the operating system itself to delete driver files and modify registry values. Devices can be removed using the Device Manager by right-clicking on the entry and selecting "Uninstall". This will delete the associated registry entries for that device only. Windows 7 provides an automatic method to delete driver files via a check box to "Delete the driver software for this device" on the uninstall dialog box.

Uninstalling the Driver Files with Converter Connected

- Click on the Windows "*start*" button to open the start menu and select "Control Panel".
- From the Control Panel window select "Hardware and Sound".
- Select "Device Manager" from "Devices and Printers". This opens the Device Manager window.
- Expand the "Ports (COM & LPT)" entry. Right click on the USB Serial Port (COMx) and select "Uninstall" (Figure 3.2.1).

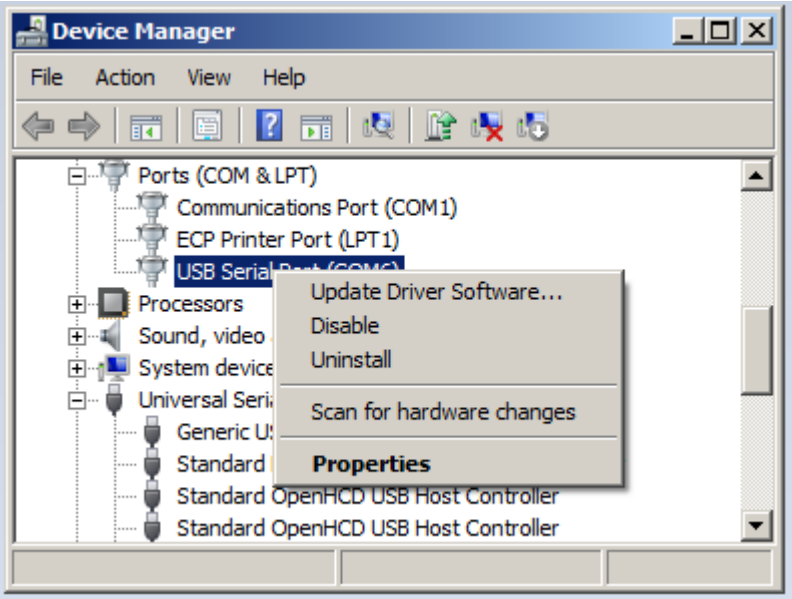


Figure 3.2.1

- A window opens that informs you that the device will be uninstalled (Figure 3.2.2). Check the "Delete the driver software for this device" box and click "OK".

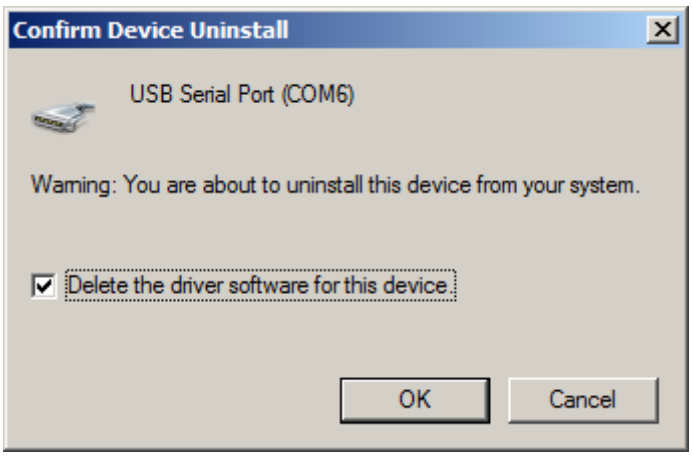


Figure 3.2.2

- Right click the USB Serial Converter under "Universal Serial Bus controllers" and select "Uninstall". A window opens that informs you that the device will be uninstalled (Figure 3.2.3). Check the "Delete the driver software for this device" box and click "OK".

Figure 3.2.3

- The registry entries and driver files for the converter are removed from the system. If uninstalling a multiple port converter repeat this procedure for any additional devices.

Uninstalling Driver Files WITHOUT Converter Connected

Devices that are not connected are not usually displayed in the Device Manger. To uninstall a disconnected device it must first be made visible in the Device Manger by performing the following procedure:

- Open "Control Panel > System & Security > System > Advanced System Settings" and click "Environment Variables…" (Fig 3.2.4).

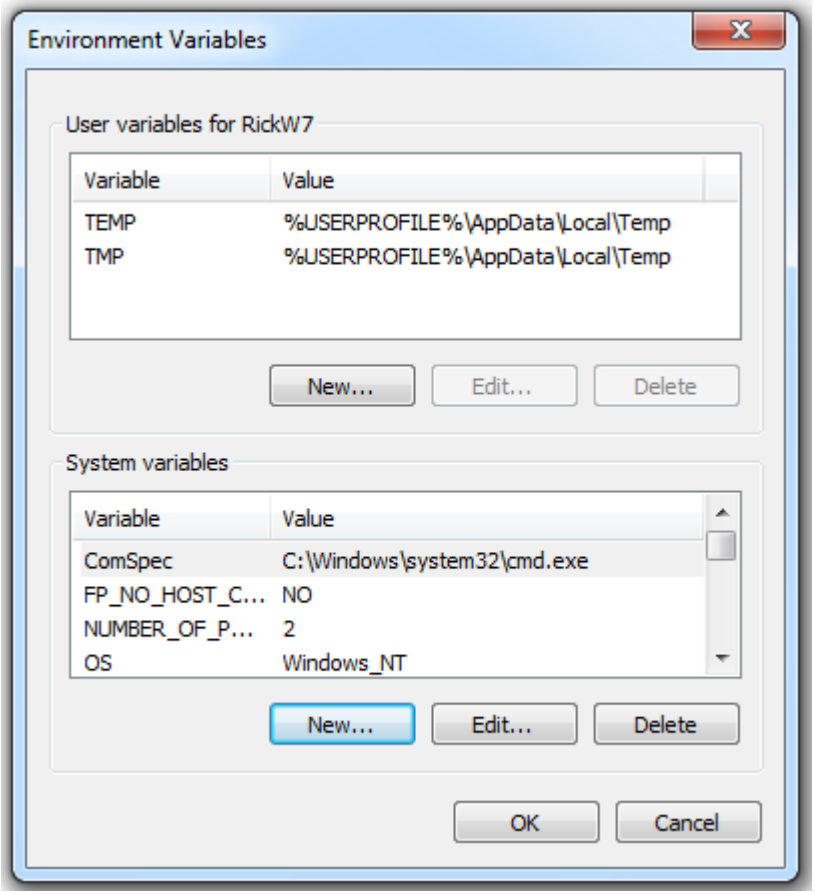


Figure 3.2.4

- In the System Variables section (NOT THE USER VARIABLES SECTION), click "New...".

- Create a new System Variable called "DevMgr_Show_NonPresent_Devices" and set the value to 1, then click "OK" (Figure 3.2.5).

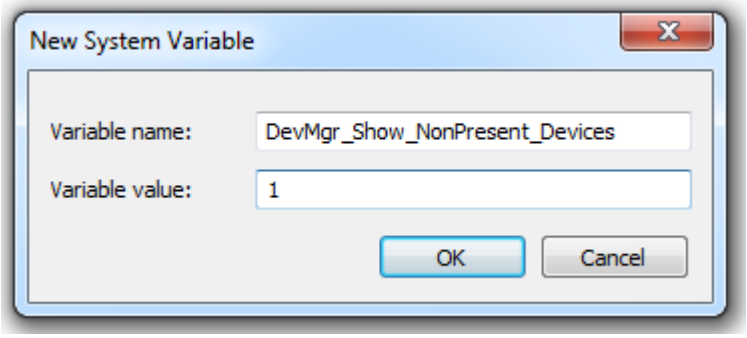


Figure 3.2.5

- The new variable will appear in the System Variable list box. Click "OK" (Figure 3.2.6).

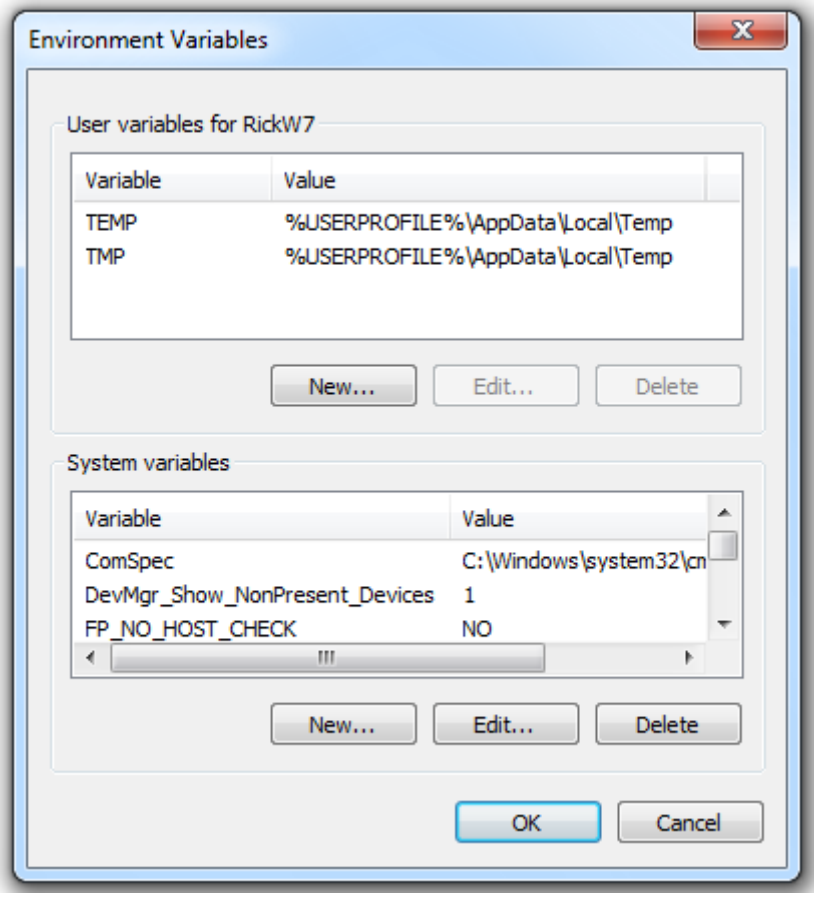


Figure 3.2.6

- Open the Device Manager and select "View > Show Hidden Devices ". Device Manager will then show all hidden and nonpresent devices (Figure 3.2.7).

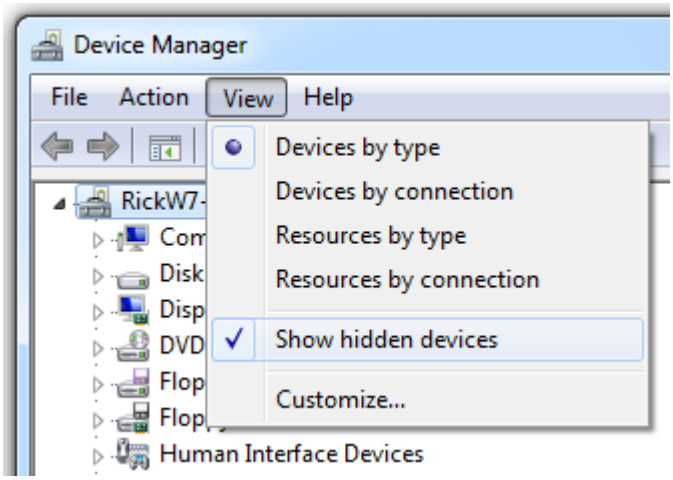


Figure 3.2.7

The converter can now be uninstalled as if it was a connected device (see *"Uninstalling the Converter Driver Files with Converter Connected"*).

3.3 Driver Installation for Windows Vista

If a Dutec converter has already been installed on the PC the new converter will automatically be installed using the existing drivers. To force the use of the new driver files the existing drivers need to be removed. Refer to the *Uninstalling Devices and Drivers for Windows Vista* section for more information.

- Insert the BaudMaster™ CD into the PC's CD-ROM drive. If a CD-ROM drive is unavailable the driver files can be downloaded as a self-extracting zip file from the Dutec website. Run the self-extracting zip file to unzip them to a directory on your PC (default location is C:\Dutec\BMUSB Driver).

- Plug the converter into an available USB port. The operating system (OS) will indicate that it has found new hardware and will search for drivers. You will need to direct the OS to search for the drivers on the CD or in the folder that was created in the previous step.

- Select "Locate and install driver software (recommended)" as shown in Fig 3.3.1.

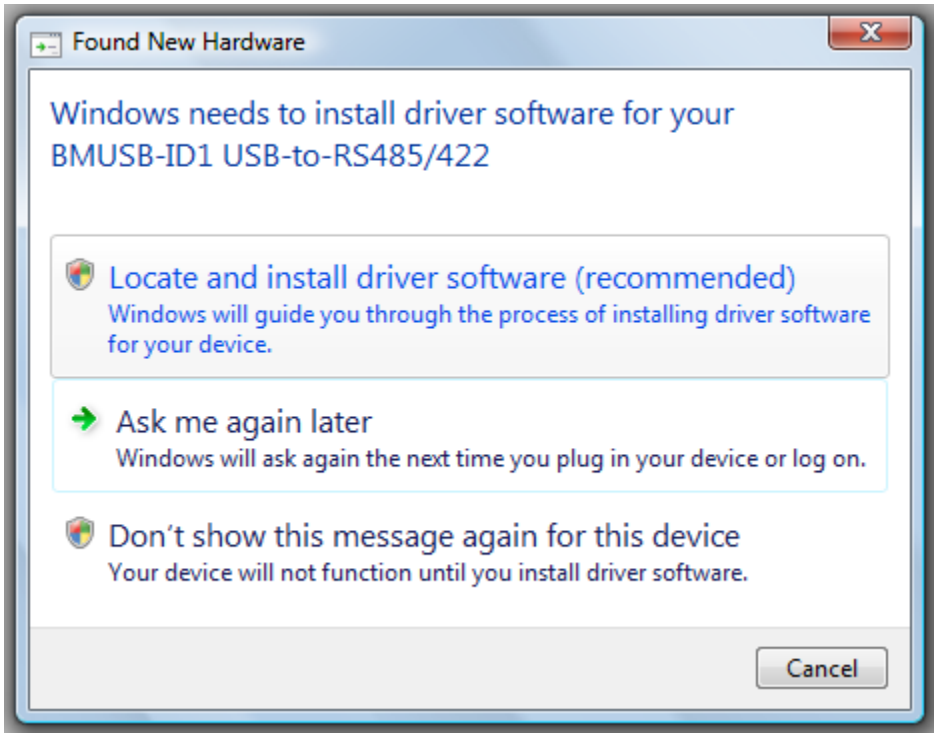


Figure 3.3.1

- If the computer is connected to the internet the OS will connect to the Windows Update site and automatically download and install the drivers (Figure 3.3.2). Refer to the end of this section for information on completing and verifying the installation.

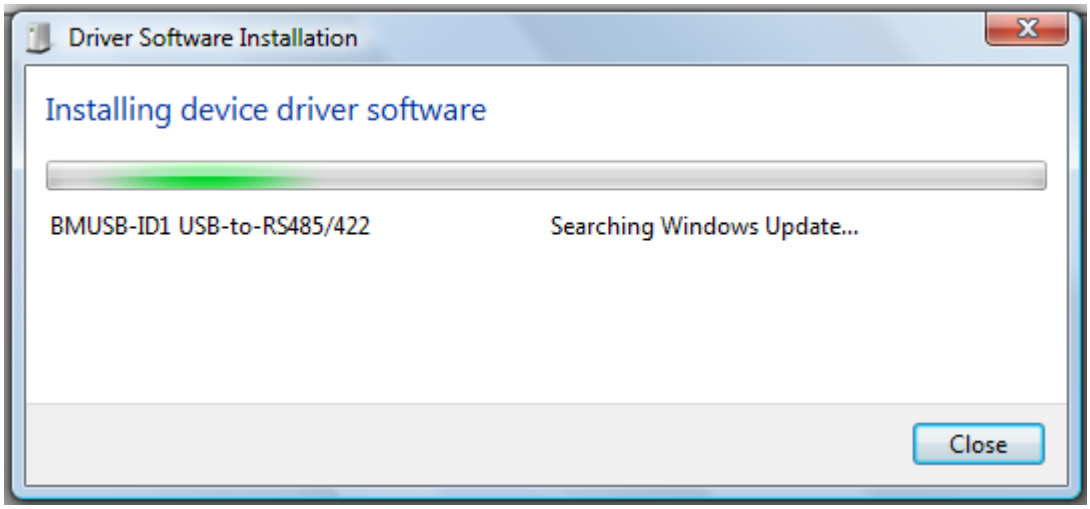


Figure 3.3.2

- If internet access isn't available the window shown in Figure 3.3.3 will appear. Select "I don't have the disc. Show me other options". Select this option even if the driver disk is installed.

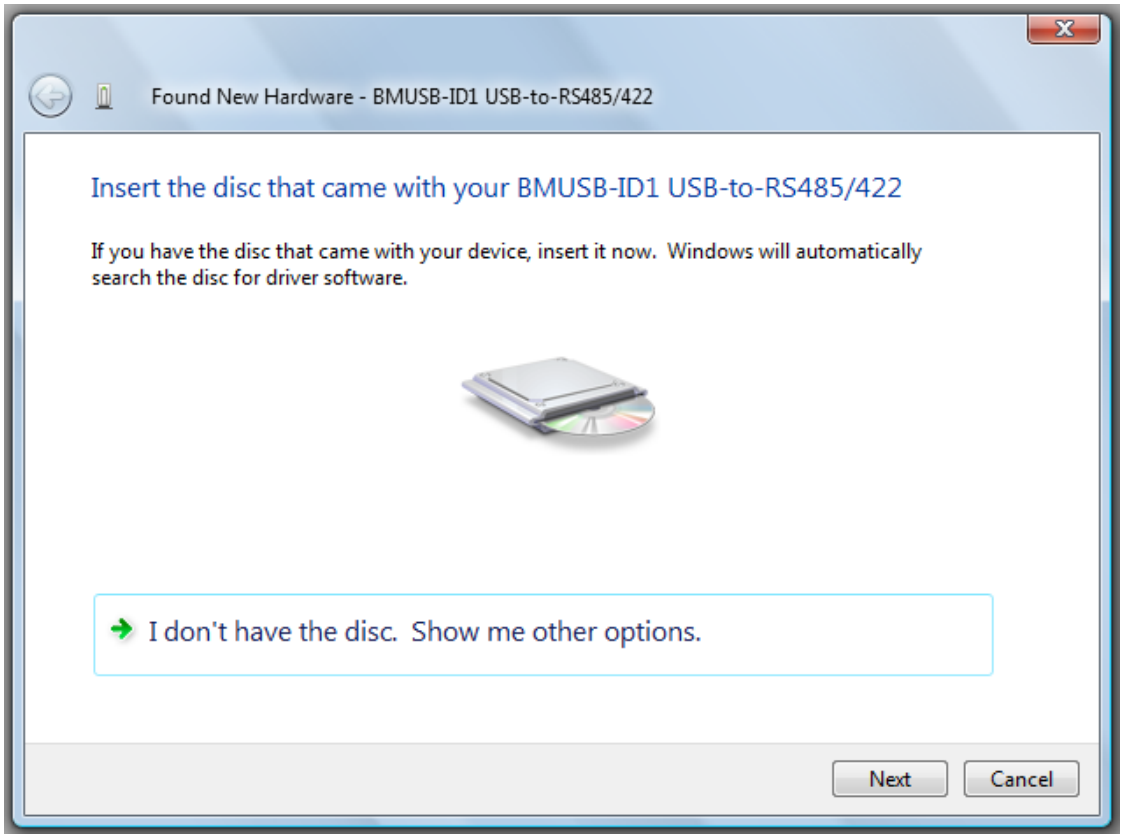


Figure 3.3.3

- Select "Browse my computer for driver software (advanced)" as shown in Figure 3.3.4.

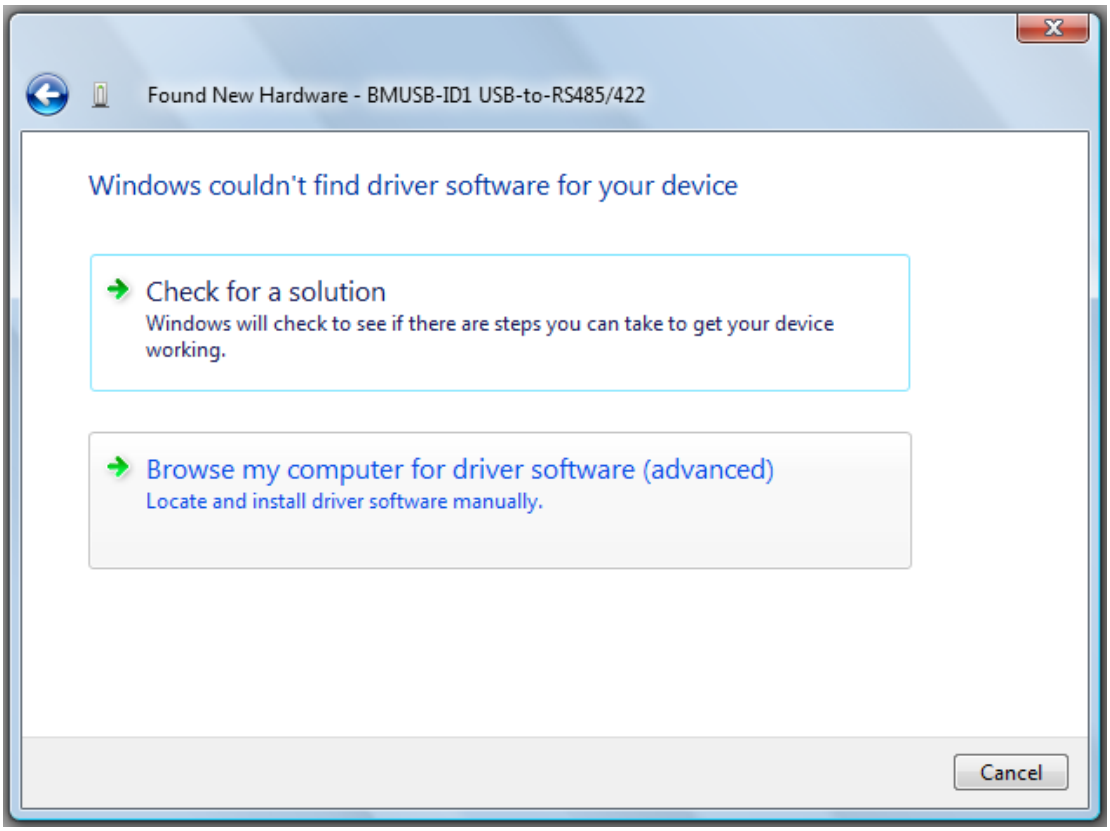


Figure 3.3.4

- Enter the driver file path in the combo-box ("E:\Dutec\BMUSB Driver" in Figure 3.3.5 below) or browse to it by clicking the browse button. The drive letter ("E:" in this example) may differ due to the PC's configuration or if selecting the folder containing the un-zipped driver files. Once the file path has been entered in the box, click "Next" to proceed.

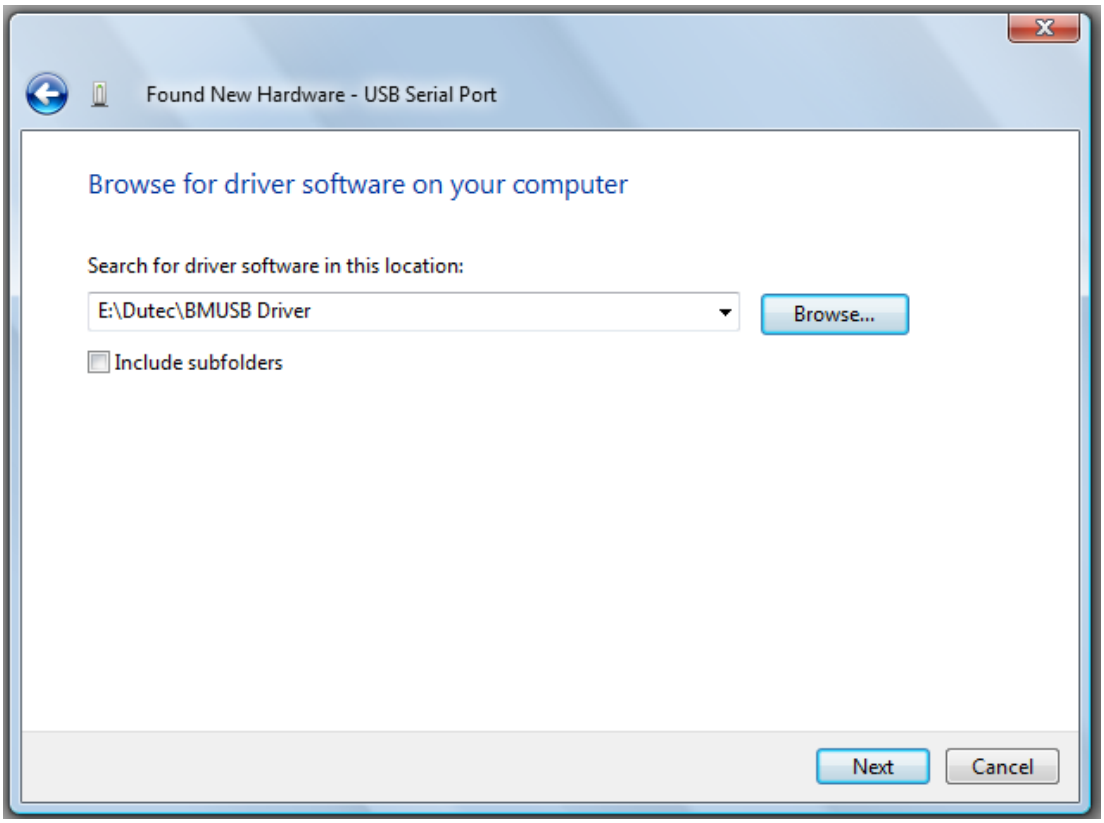


Figure 3.3.5

- The operating system will display a screen as it copies the driver files and then the screen shown in Figure 3.3.6 should be displayed to indicate that the installation was successful. Click "Close" to complete the first part of the installation.

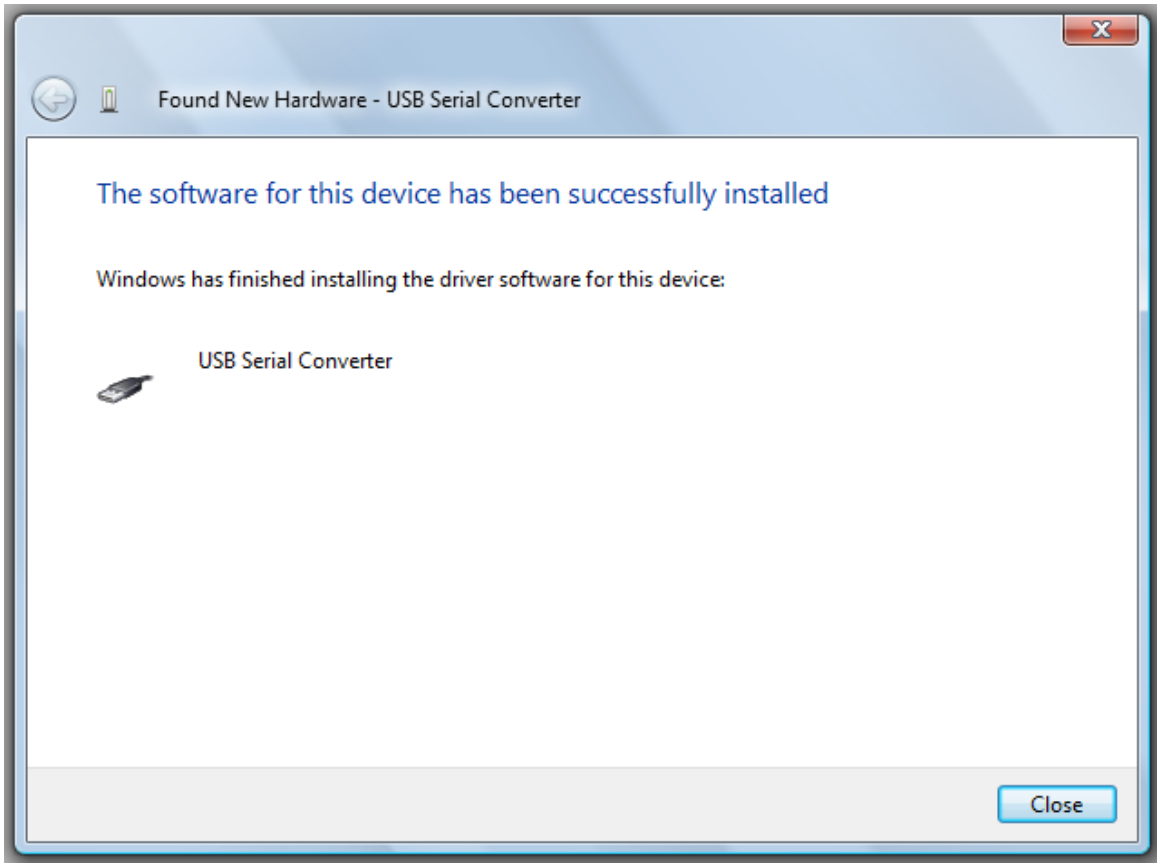


Figure 3.3.6

- The Found New Hardware Wizard will launch automatically to install the COM port emulation drivers. As above, select "I don't have the disc. Show me other options" as shown in Figure 3.3.7.

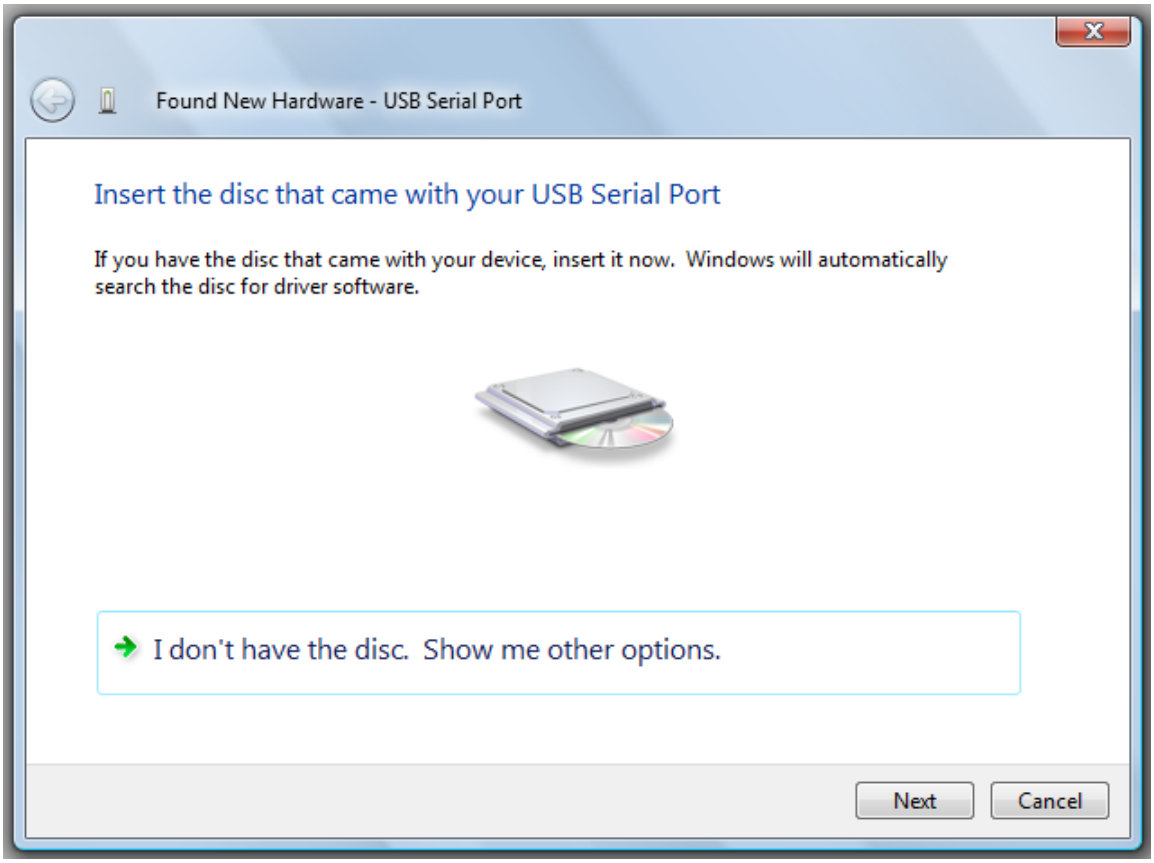


Figure 3.3.7

- Select "Browse my computer for driver software (advanced)" as shown in Figure 3.3.8.

Figure 3.3.8

- Enter the driver file path in the location box as shown in Figure 3.3.9 or browse to it by clicking the browse button. Once the file path has been entered in the box click "Next" to proceed.

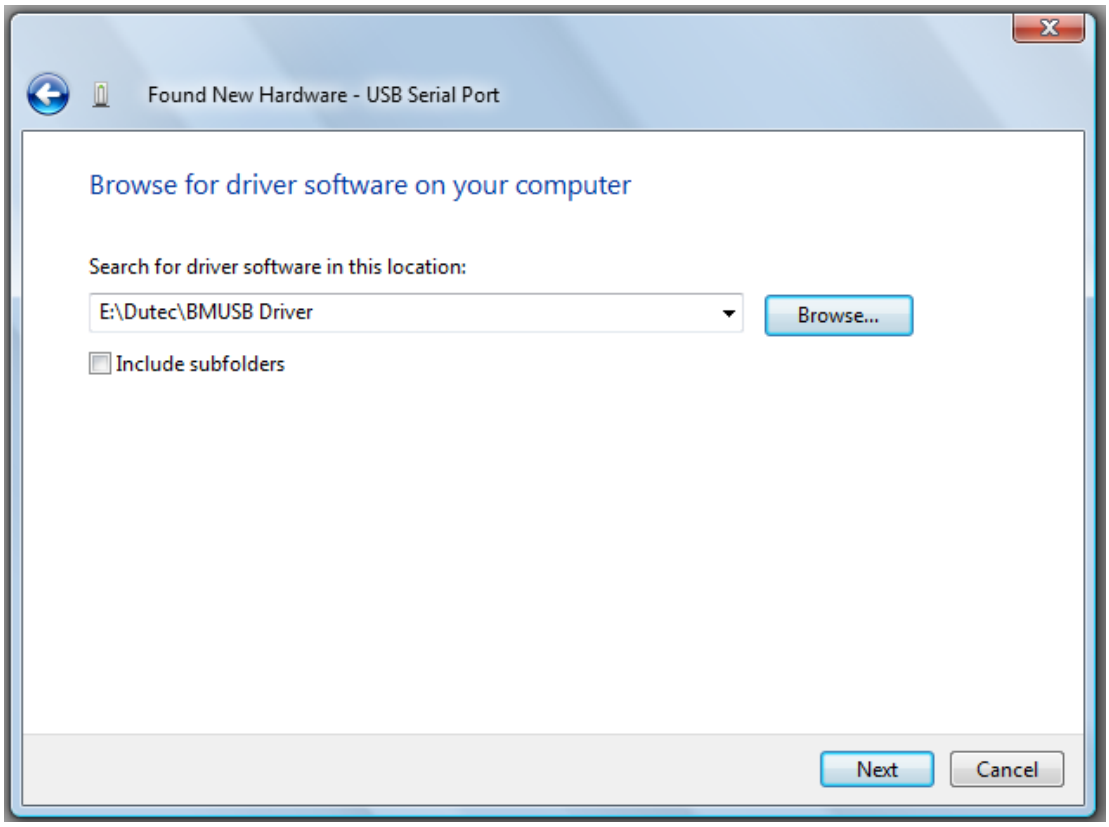


Figure 3.3.9

- The operating system will display a screen as it copies the driver files and then the screen shown in Figure 3.3.10 should be displayed to indicate that the installation was successful. Click "Close" to complete the first part of the installation.

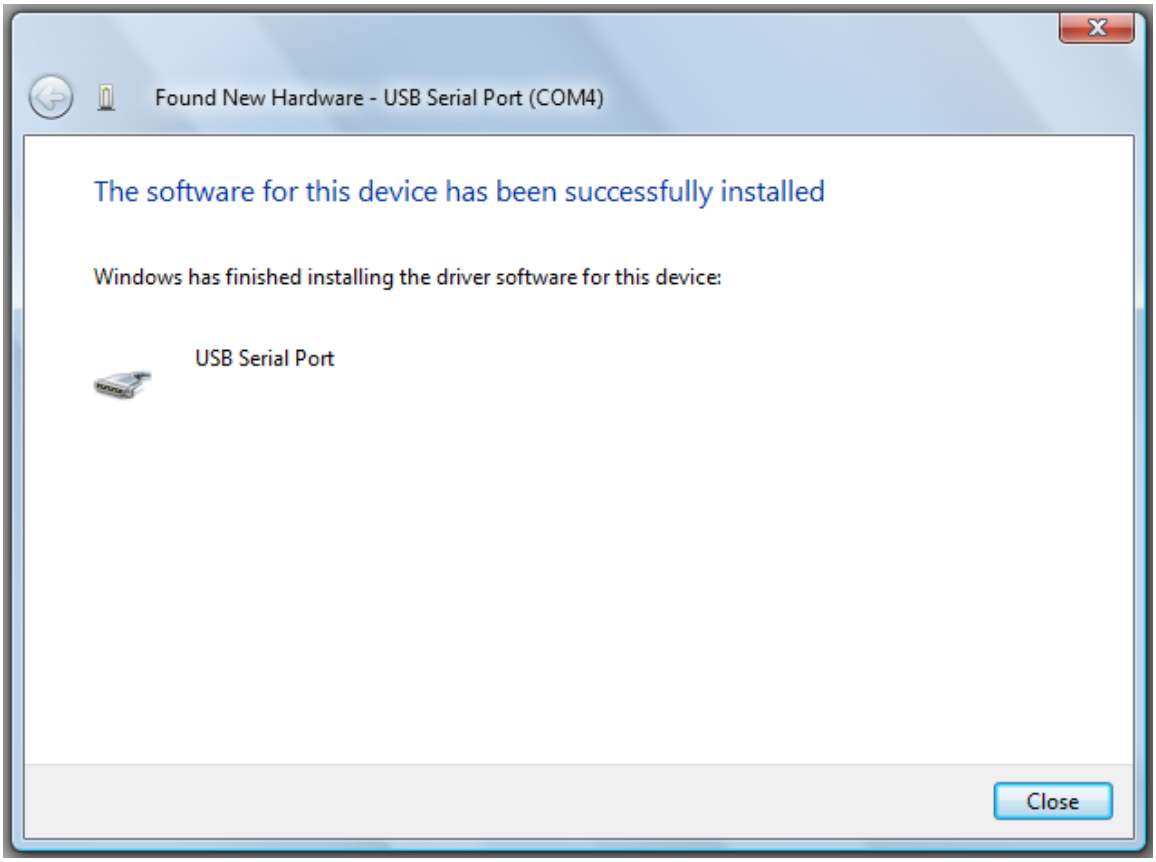


Figure 3.3.10

- If installing a multiple port converter Windows Vista will automatically install the drivers for the additional serial ports after completing the initial port installation.

- The operating system will display a message indicating that the converter is ready to use. Click on the message box and a summary is displayed as shown in Figure 3.3.11 (the COM number may vary). Click "Close".

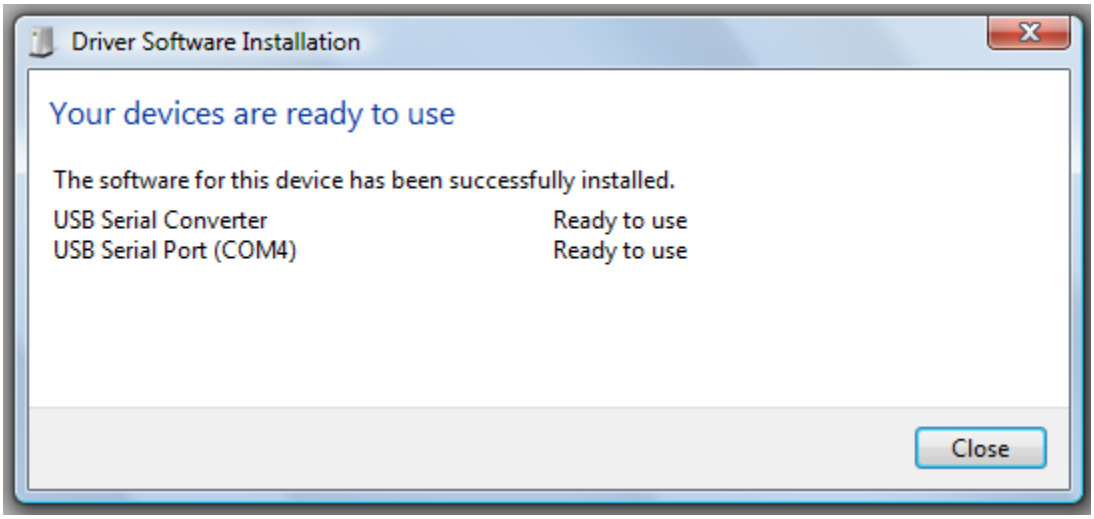


Figure 3.3.11

- After successfully completing the driver installation the converter will be assigned a communications port (Com Port) number. To find this assignment and other device information run the program *PortFinder* which is located on the installation CD.

- Click the 'Request Com Port Info' button to get information on all installed Dutec converters.

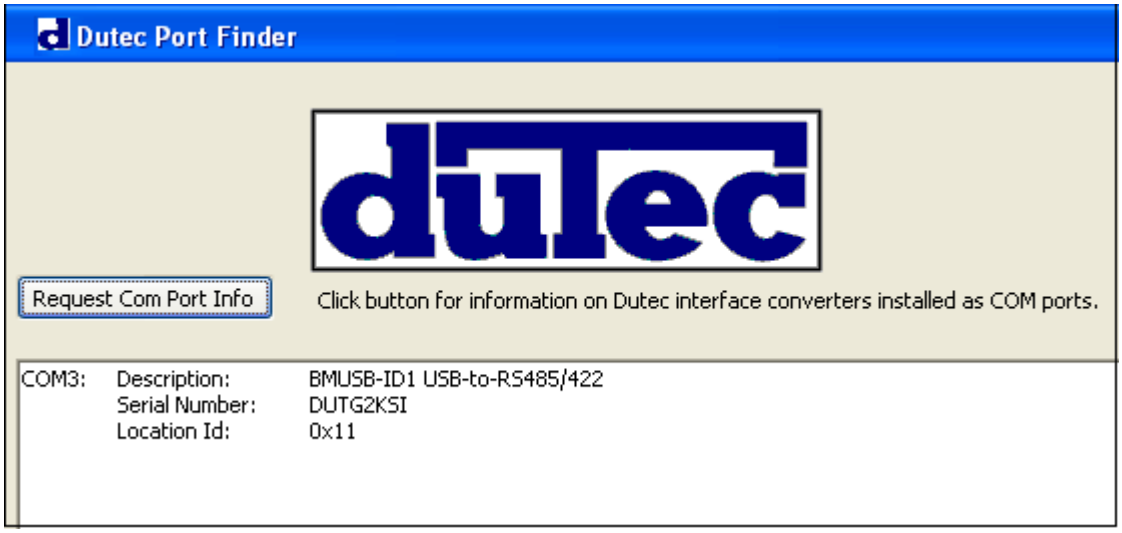


Figure 3.3.12

3.4 Uninstalling Devices and Drivers for Windows Vista

Uninstalling the Device and Driver Files with Converter Connected

- Open the Device Manager (located in 'Control Panel\System' then select 'Device Manger') and select 'View > Devices by type'. Expand the 'Ports (COM & LPT)' and 'Universal Serial Bus controllers' groups. The device appears as a 'USB Serial Port' under 'Ports' and as a 'USB Serial Converter' under 'Universal Serial Bus controllers' (Figure 3.4.1).

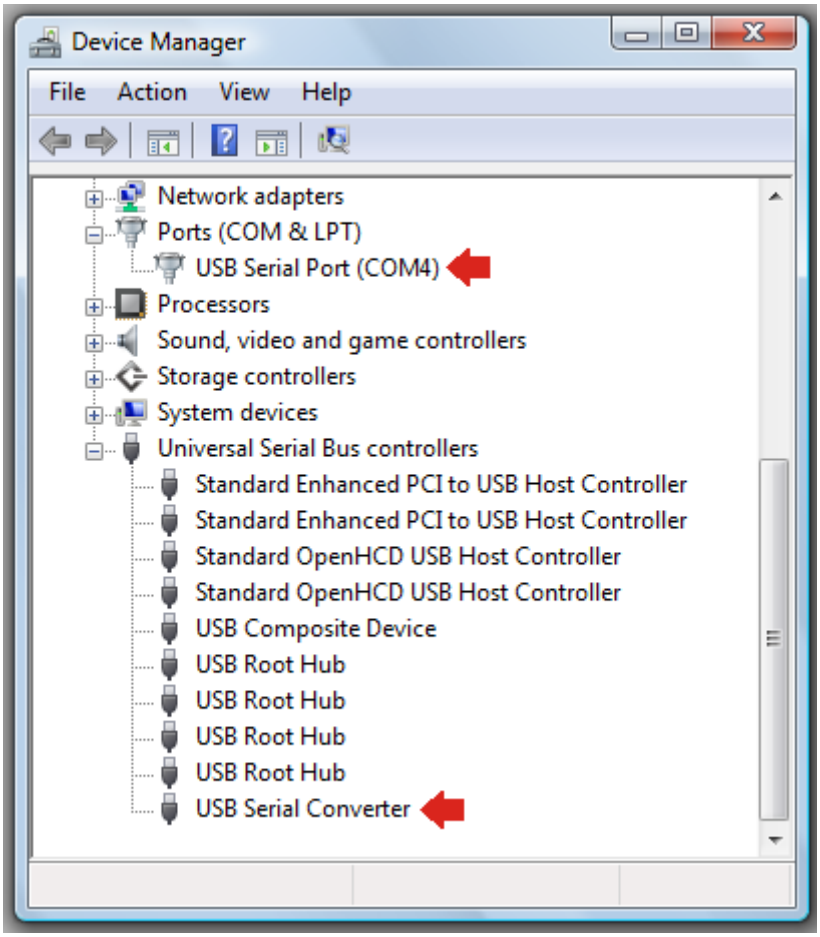


Figure 3.4.1

- Right click the device under 'Ports (COM & LPT)' and select 'Uninstall'. A window opens that informs you that the device will be uninstalled (Figure 3.4.2). Check the 'Delete the driver software for this device' box and click 'OK'.

Figure 3.4.2

- Right click the device under 'Universal Serial Bus controllers' and select 'Uninstall'. A window opens that informs you that the device will be uninstalled (Figure 3.4.3). Check the 'Delete the driver software for this device' box and click 'OK'.

Figure 3.4.3

- The registry entries and driver files for the converter are removed from the system.

- If uninstalling a multiple port converter perform the above steps for all BaudMaster™ USB devices. Uninstall the USB Serial Port (COM) entries before uninstalling the Universal Serial Bus controller entries.

Uninstalling the Device and Driver Files WITHOUT Converter Connected

Devices that are not connected are not usually displayed in the Device Manger. To uninstall a disconnected device it must first be made visible in the Device Manger by performing the following procedure:

- Open 'Control Panel > System' then select the 'Advanced' tab and click 'Environment Variables' (Figure 3.4.4).

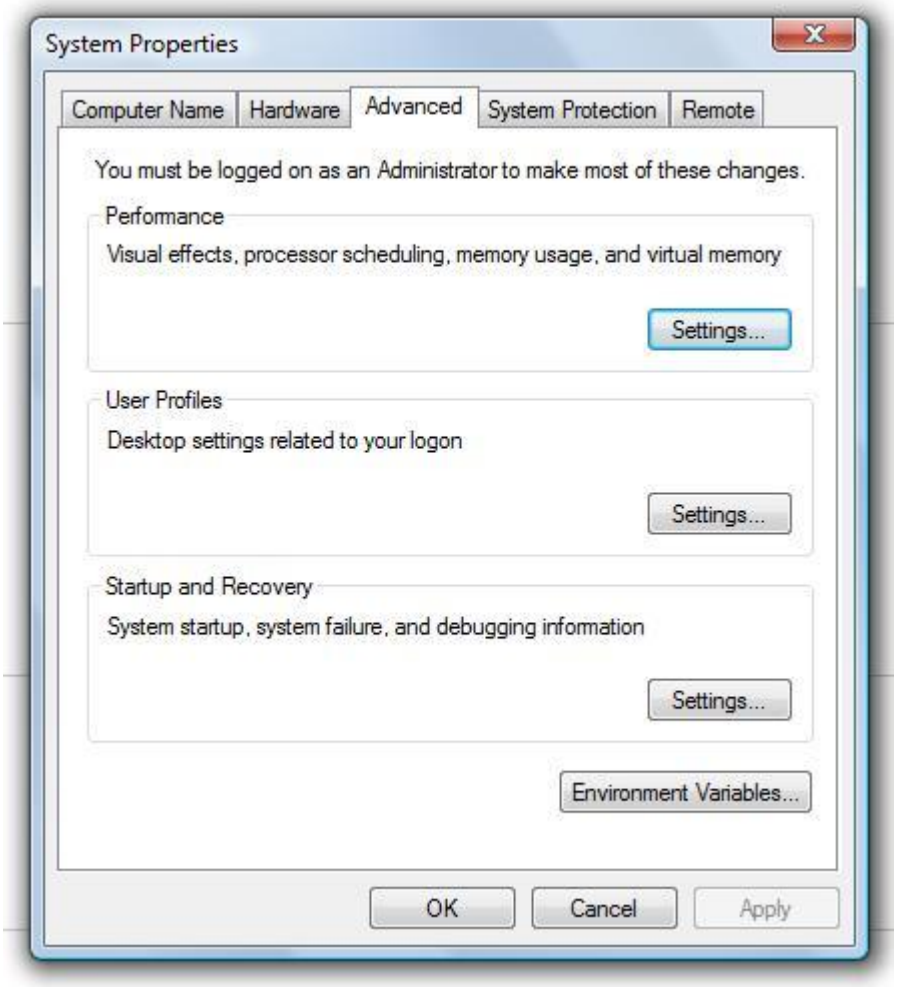


Figure 3.4.4

- In the System Variables section **(NOT THE USER VARIABLES SECTION),** click 'New…' to display the window shown in Figure 3.4.5.

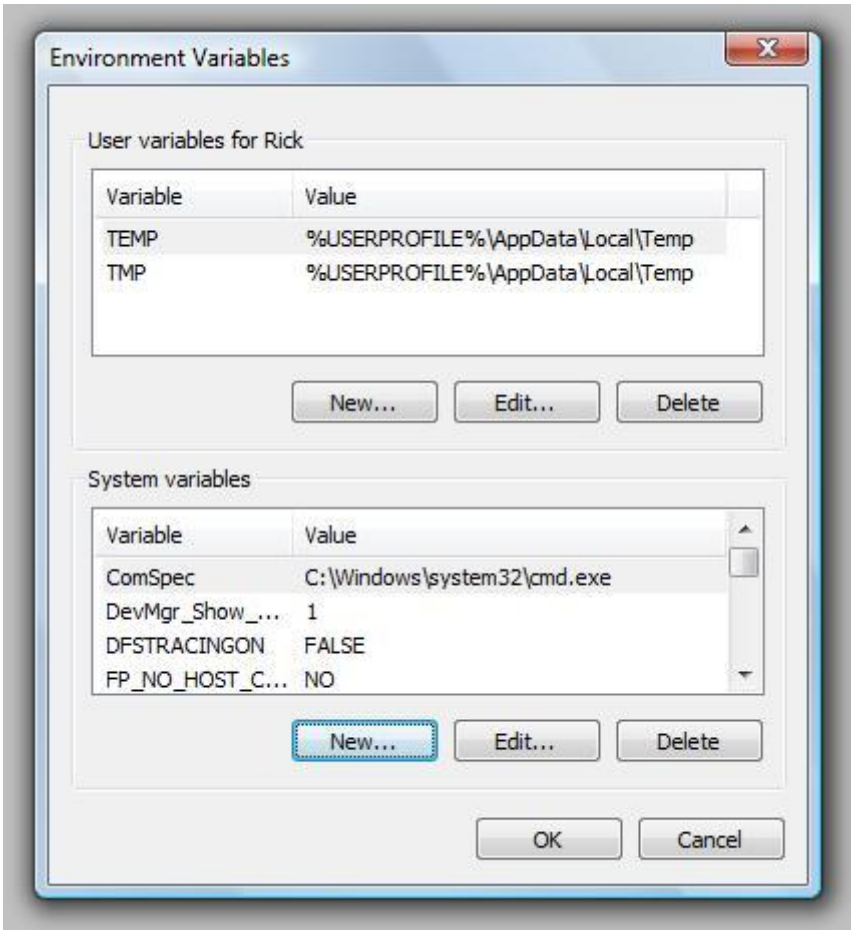


Figure 3.4.5

- Create a new System Variable called 'DevMgr_Show_NonPresent_Devices' and set the value to 1, then click 'OK' (Figure 3.4.6).

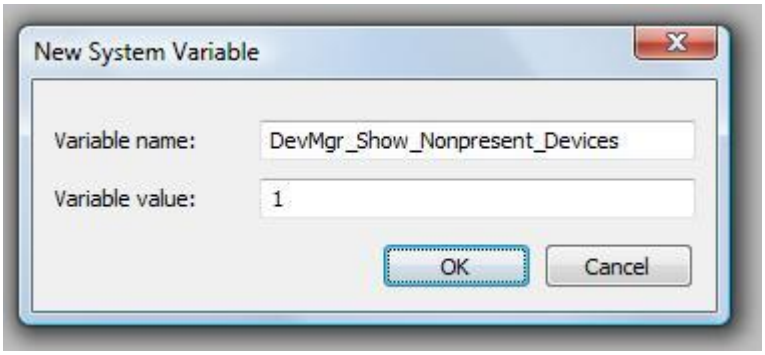


Figure 3.4.6

- Open the Device Manager (located in 'Control Panel\System' then select 'Device Manger') and select 'View > Show Hidden Devices '. Device Manager will then show all hidden and nonpresent devices available on that PC as shaded.

  The device can now be uninstalled as if it was a connected device (see 'Uninstalling the Device and Driver Files with Converter Connected').

3.5 Driver Installation for Windows XP

Installing via the *Found New Hardware Wizard*

If a Dutec converter has already been installed on the PC the new converter will automatically be installed using the existing drivers. To force the use of the new driver files the existing drivers need to be removed. Refer to the *Uninstalling Converter Driver Files for Windows XP section* for more information.

- Insert the BaudMaster™ CD into the PC's CD-ROM drive. If a CD-ROM drive is unavailable the driver files can be downloaded as a self-extracting zip file from the Dutec website. Run the self-extracting zip file to unzip them to a directory on your PC (default location is C:\Dutec\BMUSB Driver).

- Plug the converter into an available USB port. The operating system (OS) will indicate that it has found new hardware and will search for drivers. You will need to direct the OS to search for the drivers on the CD or in the folder that was created in the previous step.

  Select 'No, not this time' and 'Next' as shown in Figure 3.5.1.

Figure 3.5.1

- Select 'Install from a list or specific location (Advanced)' as shown in Figure 3.5.2 below and then click 'Next'.

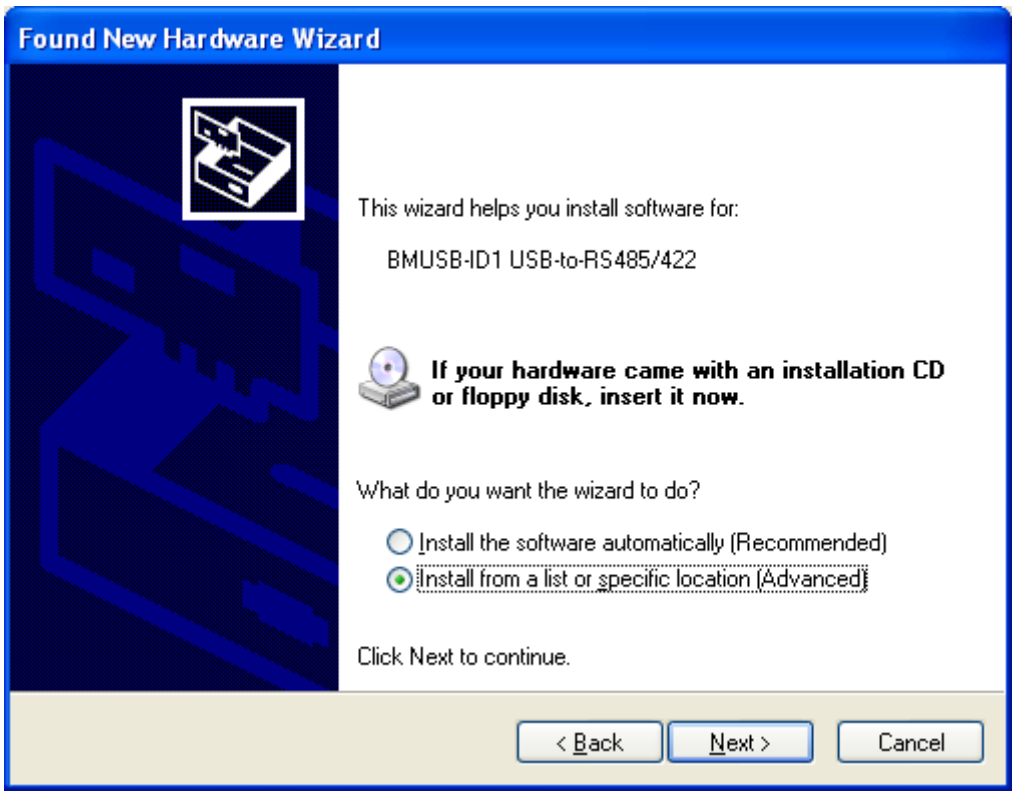


Figure 3.5.2

- Select 'Search for the best driver in these locations' and enter the file path in the combo-box ('D:\Dutec\BMUSB Driver' in Figure 3.5.3 below) or browse to it by clicking the 'Browse' button. The drive letter ('D:' in this example) may differ due to the PC's configuration or if selecting the un-zipped driver files. Once the file path has been entered in the box click 'Next' to proceed.

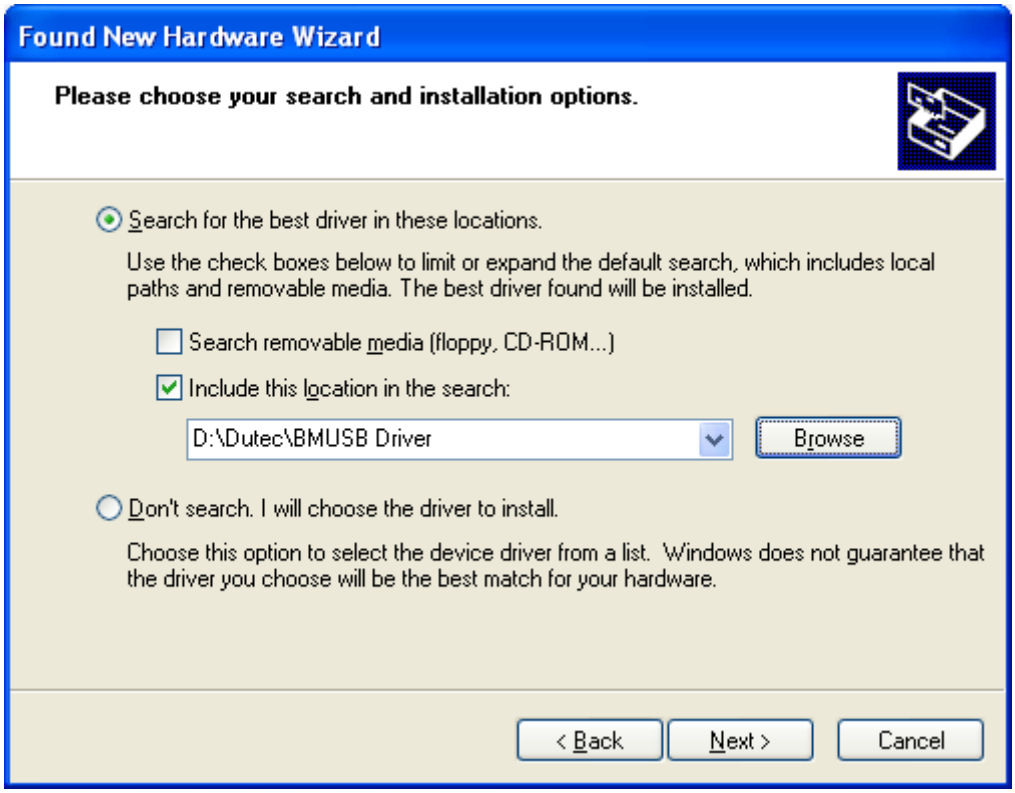


Figure 3.5.3

- The operating system will display a screen as it copies the driver files and then the screen shown in Figure 3.5.5 should be displayed to indicate that the installation was successful. Click 'Finish' to complete the installation.

Figure 3.5.5

- The Found New Hardware Wizard will launch automatically to install the COM port emulation drivers. As above, select 'No, not this time' from the options and click 'Next' to proceed with the installation (Figure 3.5.6).

Figure 3.5.6

- Select 'Install from a list or specific location (Advanced)' as shown in Figure 3.5.7 below and then click 'Next'.

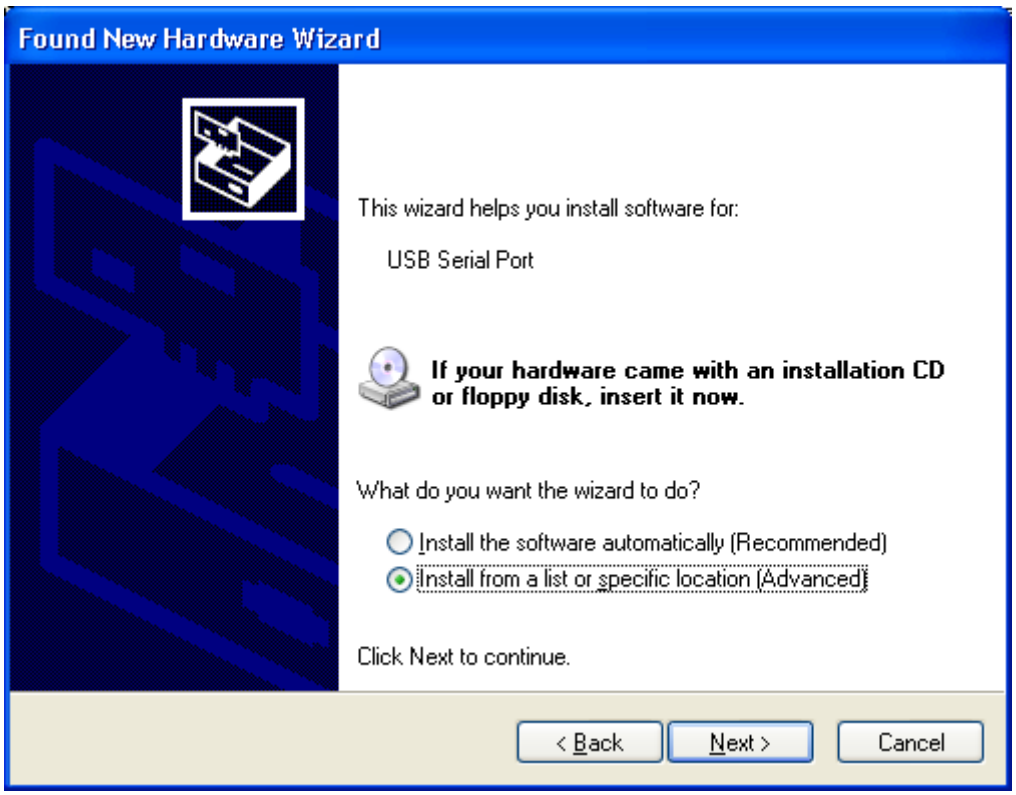


Figure 3.5.7

- Select 'Search for the best driver in these locations' and enter the file path in the combo-box or browse to it by clicking the 'Browse' button. Once the file path has been entered in the box click 'Next' to proceed.

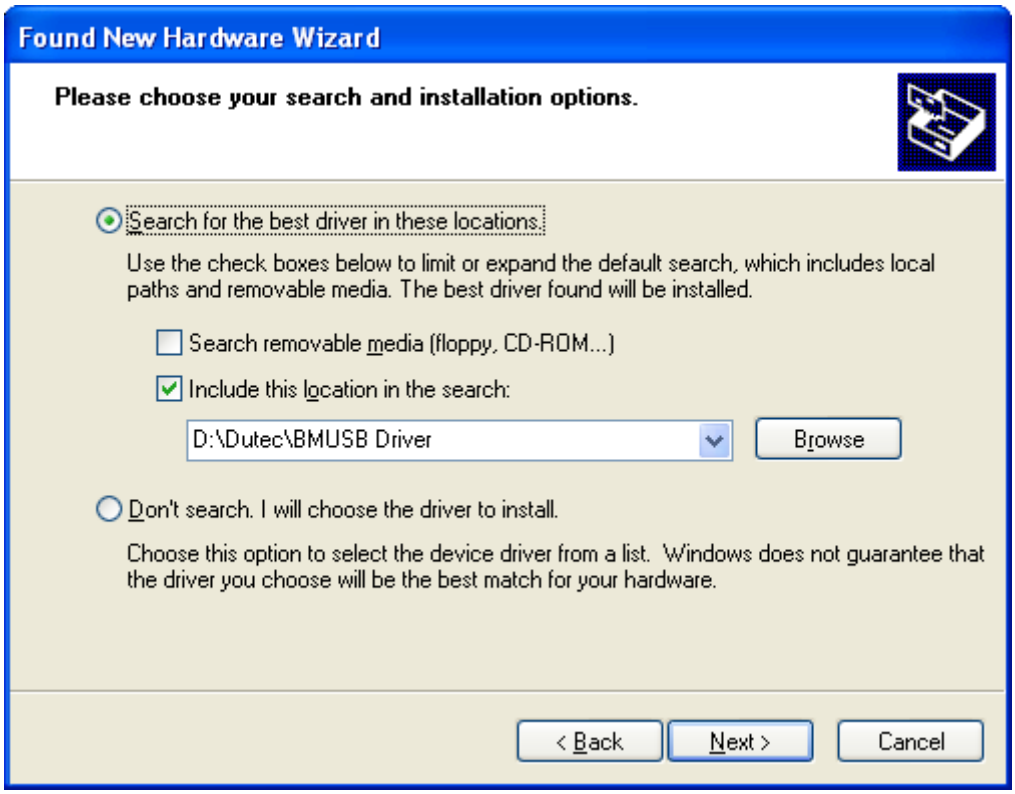


Figure 3.5.8

- The operating system will display a screen as it copies the driver files and then the screen shown in Figure 3.5.9 should be displayed to indicate that the installation was successful. Click 'Finish' to complete the installation.

Figure 3.5.9

- If installing a multiple port converter repeat the procedure for each additional COM port.

- After successfully completing the driver installation the converter will be assigned a communications port (Com Port) number. To find this assignment and other device information run the program *PortFinder* which is located on the installation CD.

- Click the 'Request Com Port Info' button to get information on all installed Dutec converters.

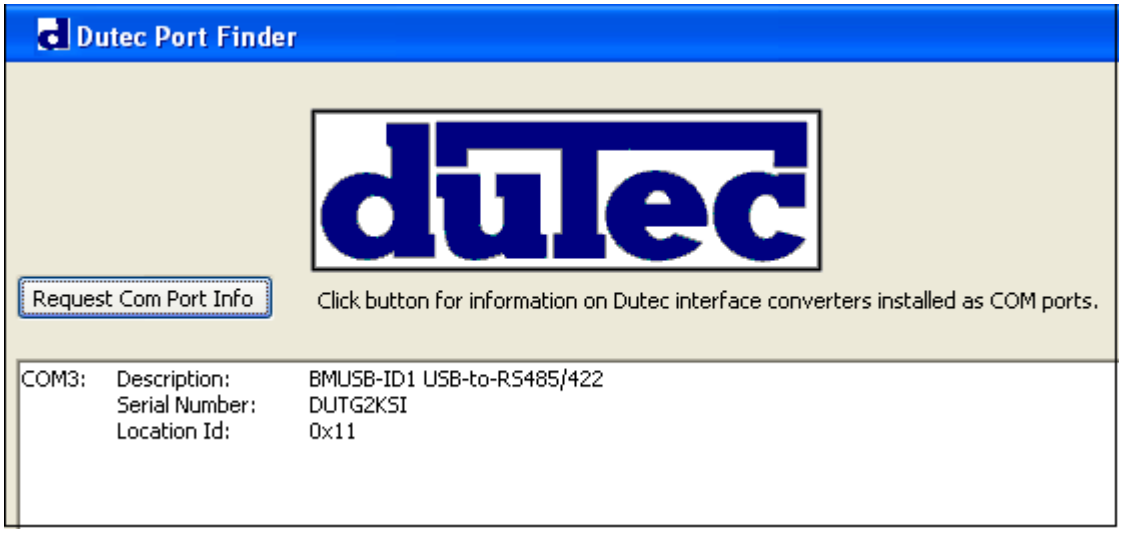


Figure 3.5.10

Installing from Windows Update (requires internet access)

- Installing from Windows Update is similar to installing via the 'Found New Hardware Wizard'. Click 'Yes, this time only' (Fig 3.5.11) and 'Install the software automatically' (Fig 3.5.12). The wizard will search the Windows Update site and automatically download and install the matching driver.

Figure 3.5.11

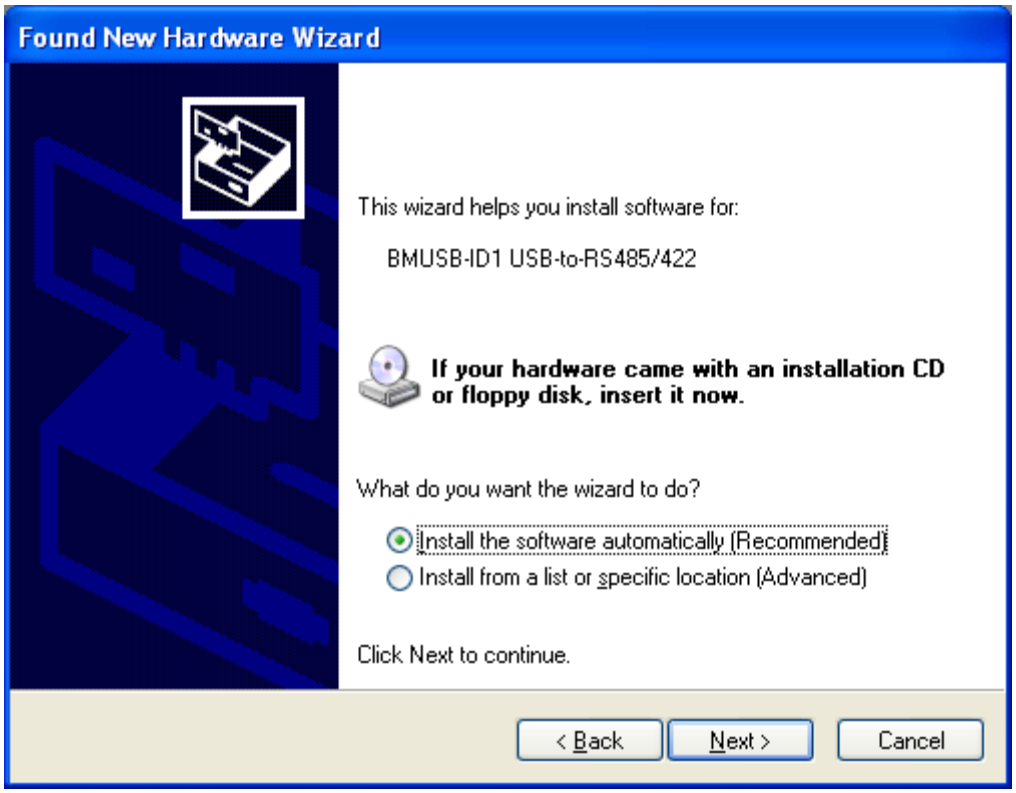


Figure 3.5.12

- After successfully completing the driver installation run the program *PortFinder* to determine Com port assignments and other information. See 'Installing via the *Found New Hardware Wizard*' for more information.

3.6 Uninstalling Devices for Windows XP

Uninstalling the Converter from the System Registry

- Open the Device Manager (located in 'Control Panel\System' then select the 'Hardware' tab and click 'Device Manger') and select 'View > Devices by type'. Expand the 'Ports (COM & LPT)' and 'Universal Serial Bus controllers' groups.

  The device appears as a USB Serial Port (COMx) and USB Serial Converter (Figure 3.6.1).

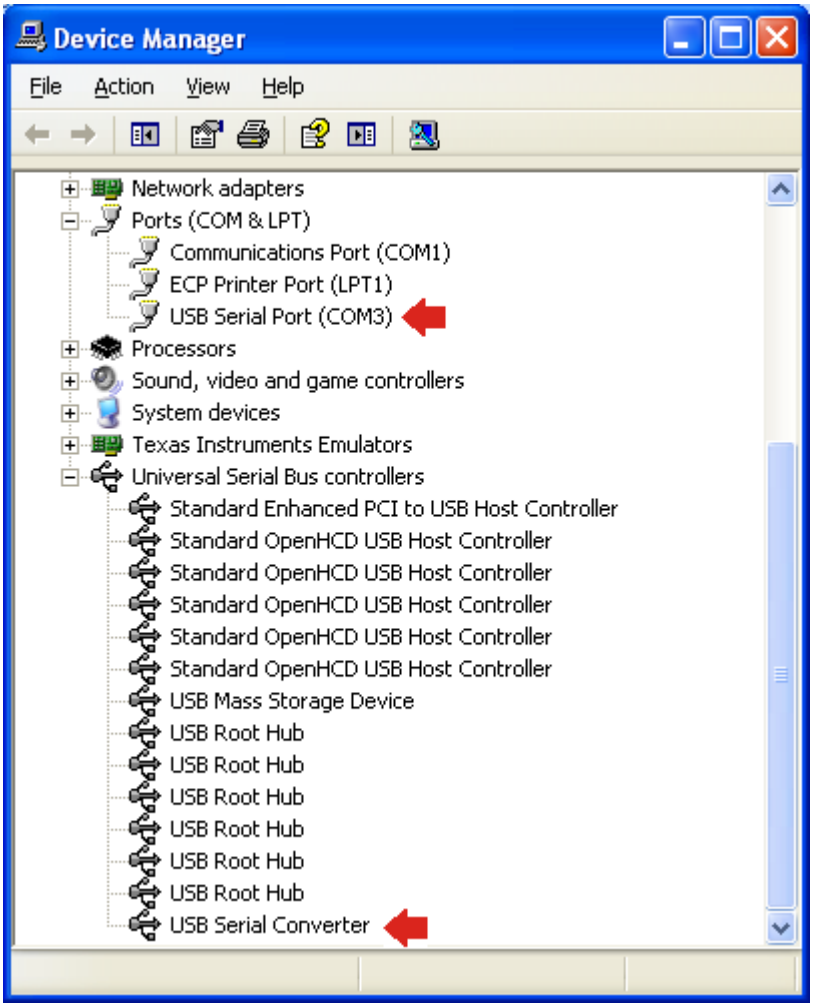


Figure 3.6.1

- Right click the device under 'Ports (COM & LPT)' and select 'Uninstall'. A window opens that informs you that the device will be uninstalled (Figure 3.6.2). Click '*OK*'.

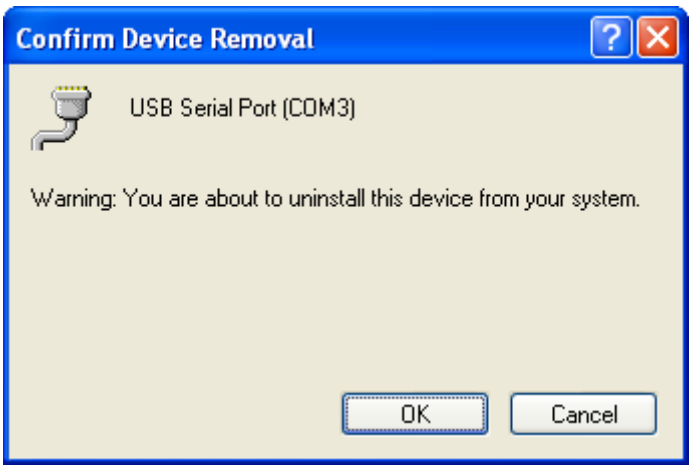


Figure 3.6.2

- If uninstalling a multiple port converter perform the above step for all BaudMaster™ COM ports.

- Right click the device under 'Universal Serial Bus controllers' and select 'Uninstall'. A window opens that informs you that the device will be uninstalled (Figure 3.6.3). Click '*OK*'.

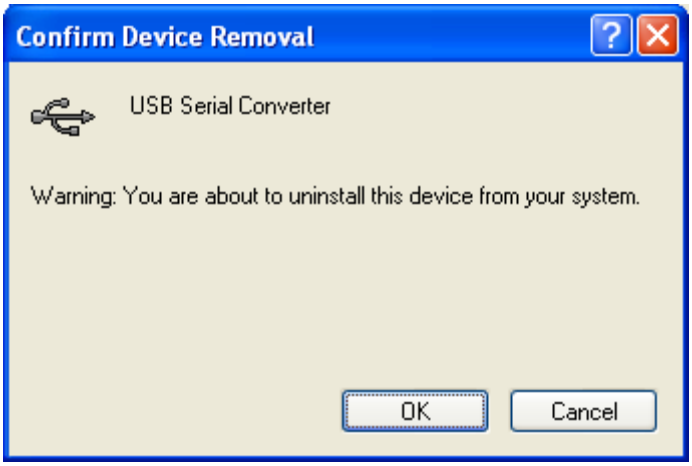


Figure 3.6.3

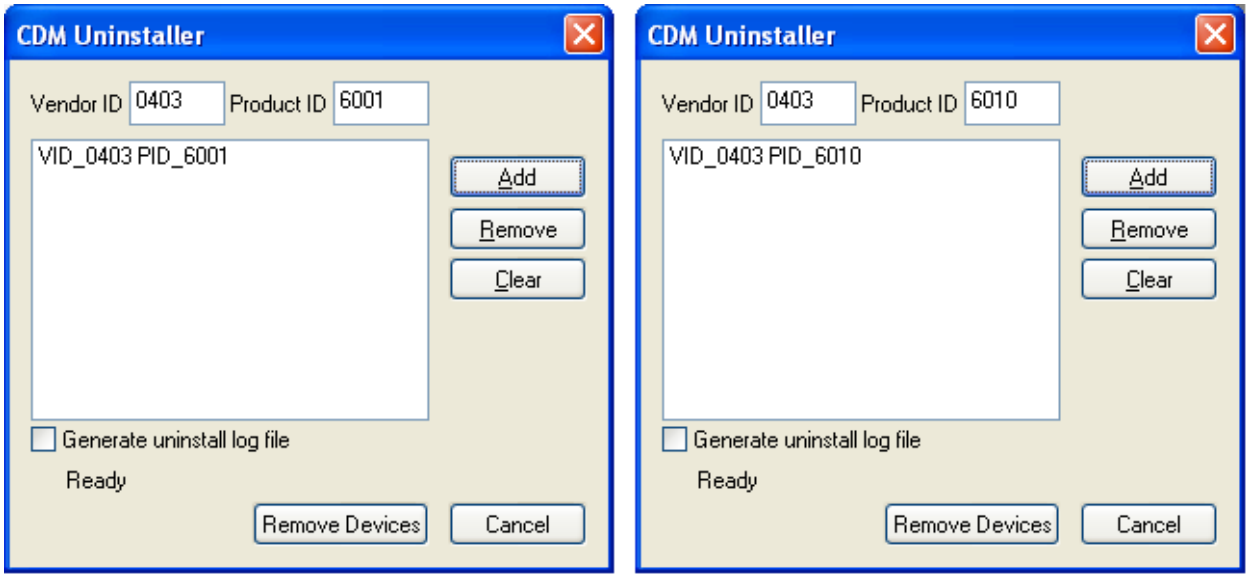
- If uninstalling a multiple port converter perform the above steps for all BaudMaster™ USB devices. Uninstall the USB Serial Port (COM) entries before uninstalling the Universal Serial Bus controller entries.

- The registry entries for the BaudMaster USB Converter have been removed from the system registry and the device is removed from the Device Manger, however, the driver files have NOT been removed from the operating system.

Uninstalling Converter Driver Files for Windows XP

- The program 'CDMuninstallerGUI.exe' located in the 'Dutec\Uninstaller' directory is used to remove the driver files from the PC. Double-click the .exe file to run the program.

- Enter the BaudMaster™ product ID and click 'Add' (Figure 3.6.4).
  1-Port Converter ID: 6001
  2-Port Converter ID: 6010



1-Port Converters **Figure 3.6.4** **2-Port Converters**

- After the converters VID and PID appear in the device window click 'Remove Devices'. A message box will confirm successful removal from the system (Figure 3.6.5).

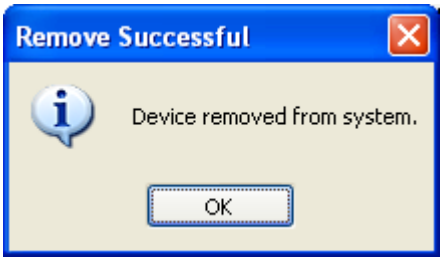
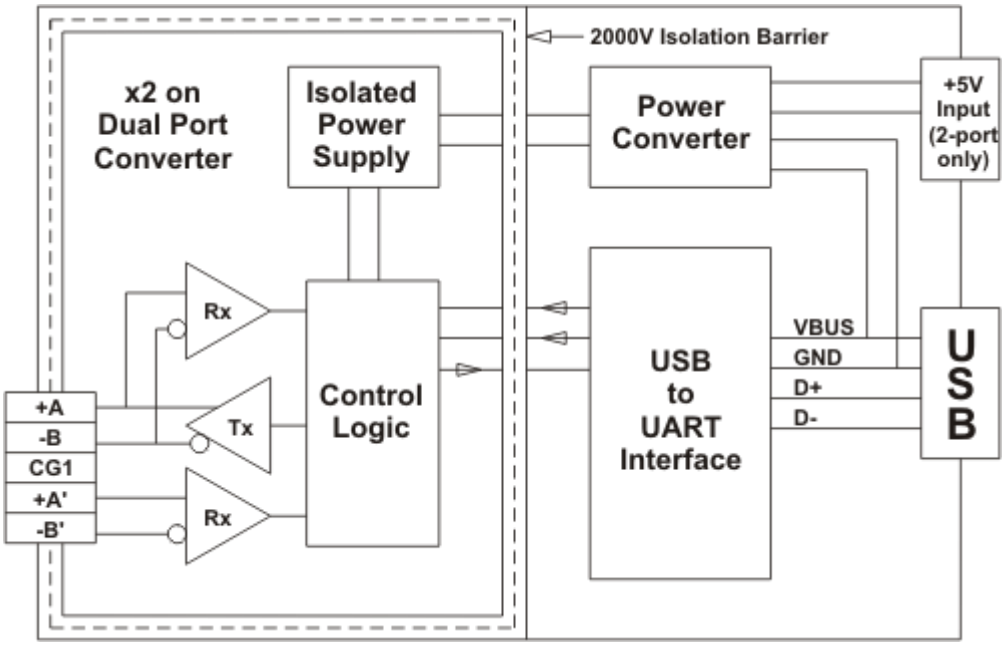


Figure 3.6.5

- The registry entries and driver files are removed from the system.

4 Description

The diagram below shows the function blocks, signal paths and isolation of the BaudMaster™ USB-to-RS485/422 converter.



The isolated BaudMaster™ converter provides full galvanic isolation from the RS485/422 interface to the USB port. Galvanic isolation breaks the signal, power and ground paths using transformer and optical technology. Data is allowed to flow between systems but not electrical current, eliminating grounding problems. All communication and power lines are transient protected.

In RS-485 applications the line driver must only be enabled when the converter is transmitting data. The BaudMaster™ converter automatically controls the driver, eliminating the need for software control.

4.1 USB Performance

BaudMaster™ USB converters transfer data using USB Bulk transfers. The most efficient way to conduct USB bulk transfers is in large chunks. The converters are bi-directional and can therefore both send and receive data across a USB connection.

If data is written in small amounts or even individual bytes as many applications written for legacy serial ports do, the USB bulk transfer protocol is only be able to transfer 1 byte per USB packet. This method is not efficient when employing USB bulk transfers and performance is greatly diminished.

Received data is returned to the host (PC) when the converter has a full buffer of data or when the device's latency timer has expired. The latency timer will trigger a transfer if there is not enough data to fill the buffer.

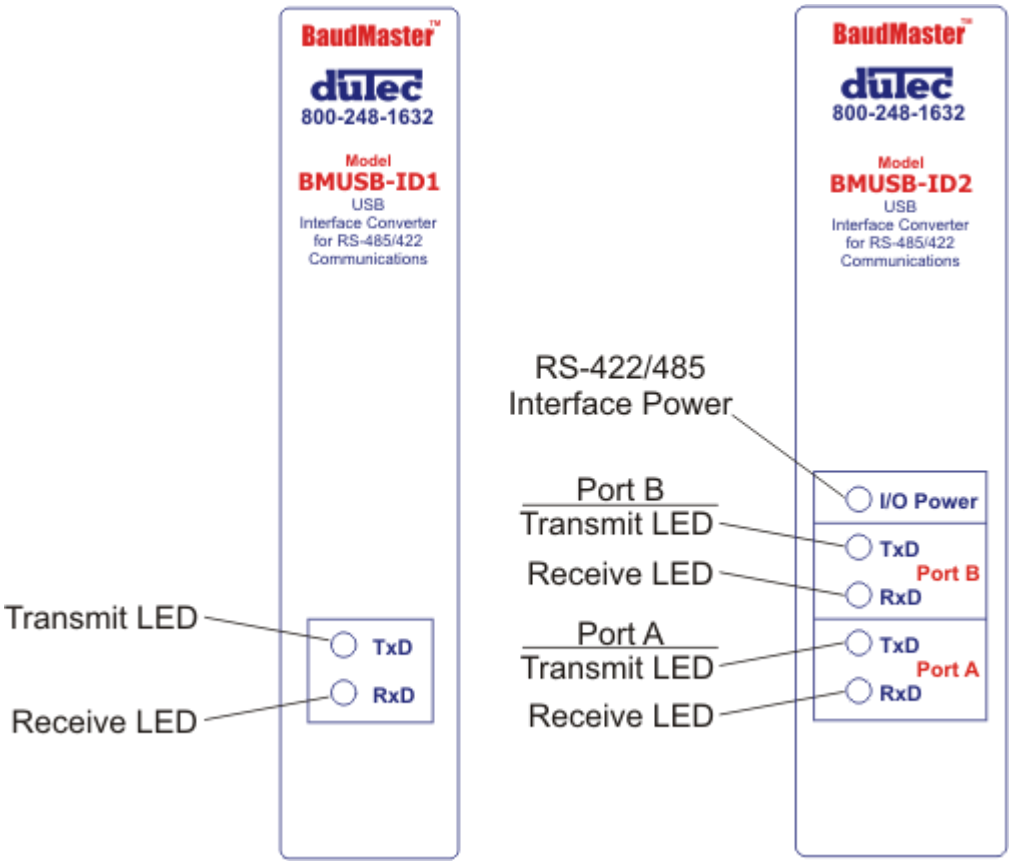
When optimizing data throughput for USB converters, the following factors should be considered:

- Send as much data to the device from the host application as possible in a single write. This will maximize the size of the data packets being sent to the device and hence minimize the number of packets required and time to transfer an amount of data.

- Set the latency timer to a value appropriate for the application. Note that a low latency timer value may result in many short incoming USB packets rather than a single large packet, thus diminishing performance.

4.2 LED Indicators

The BaudMaster™ converter has several status LED indicators. These indicators show the status of data communications and are handy for verifying operation and troubleshooting network problems.



LED Name	LED Function
TxD	Transmit - Red indicates that the converter is sending data.
RxD	Receive - Red indicates that the converter is receiving data.
I/O Power	Power for the RS-485/422 interface circuit

5 Configuration

The BaudMaster™ can be configured to accommodate various RS-485/422 networks. The DIP switches allow the device to be configured to operate in these modes:

RS-485 without Echo Multidrop mode for communication in half duplex (2-wire) networks or as a master in full duplex (4-wire) networks. The transmitter is enabled and the receiver is disabled when data is sent. In this mode the communications port will not "hear itself talk".

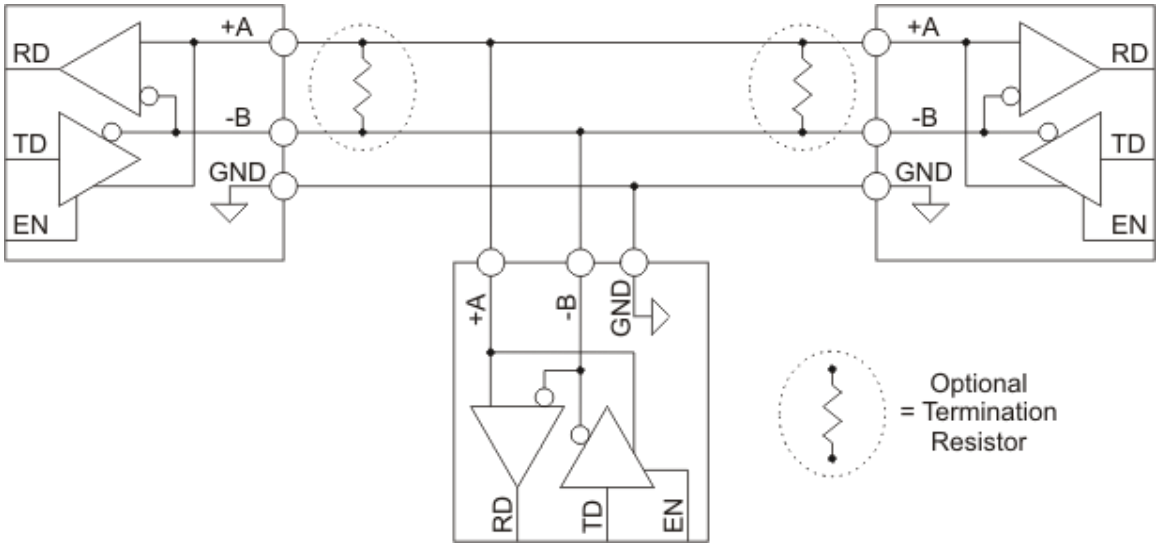
RS-485 with Echo Multidrop mode for communication in half duplex (2-wire) networks. The transmitter is enabled when data is sent and the receiver is always enabled. In this mode the communications port will "hear itself talk".

RS-485 Full Duplex Slave Multidrop mode for communication as a slave in full duplex (4-wire) networks. The transmitter is enabled when data is sent and the receive line to the master is always enabled. The communications port will not "hear itself talk" or receive data from other slaves.

RS-422 Full duplex communication in 4-wire networks or one-way communication in 2-wire networks. The transmitter and receiver are always enabled. The communications port will not "hear itself talk".

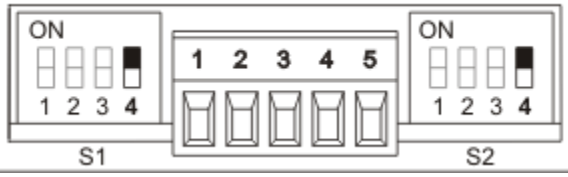
The following sections give more detail on the configuration and operation of RS-485 and RS-422 networks.

5.1 Half Duplex RS-485 Network



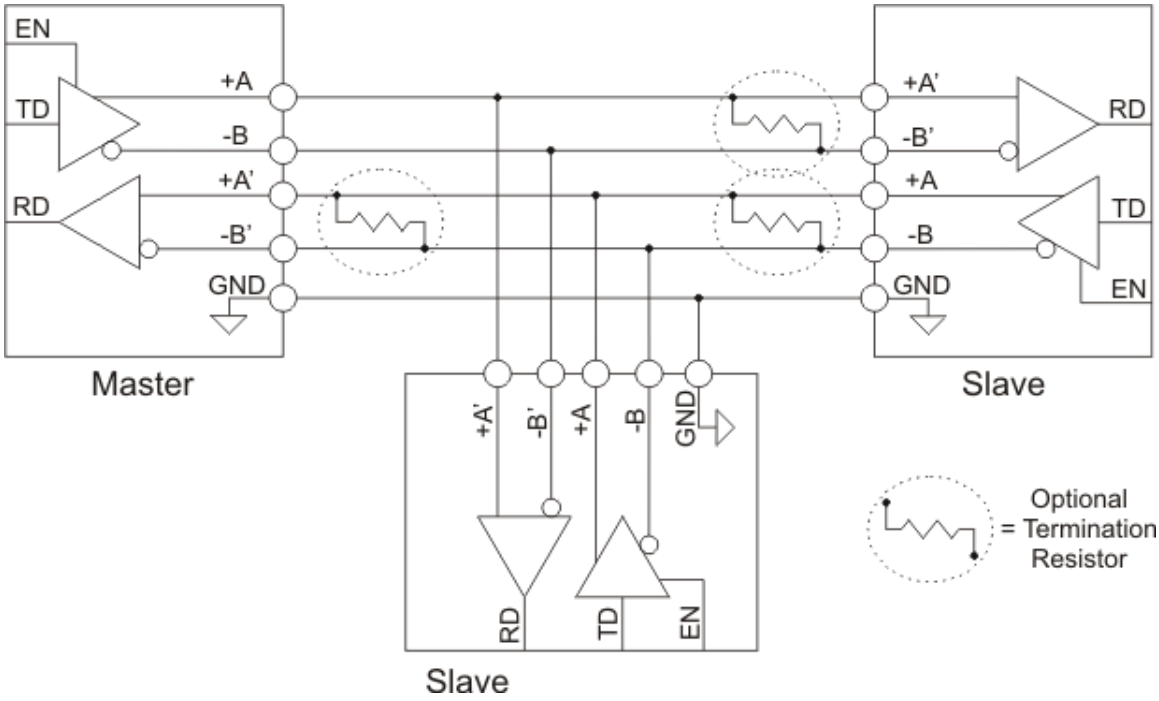
- Twisted pair connection between devices (32 devices max).
- Transmitters do not drive network when idle.
- Optional termination at both ends of network (see *Network Termination*).
- Optional line bias at one end (see *Network Bias*).
- Ground connection (GND) required between devices.
- Transmit data is heard on receiver if echo mode is enabled.

DIP Switch Settings
for
Half-Duplex RS-485 Network
without Echo



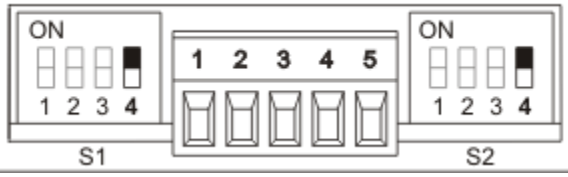
DIP Switch Settings
for
Half-Duplex RS-485 Network
with Echo

5.2 Full-Duplex RS-485 Network



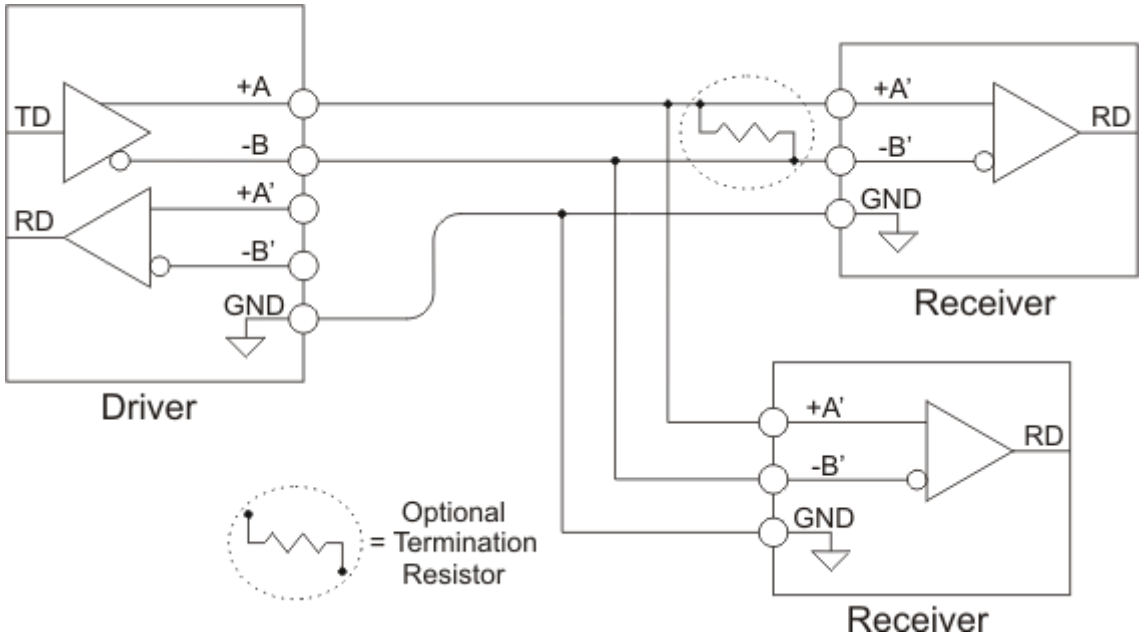
- Twisted pair connection between devices (32 devices max).
- Transmitters do not drive network when idle.
- One master device transmits to multiple slave devices over one twisted pair.
- Slave devices share one twisted pair to transmit data to master device.
- Master transmit line terminated at far end if master is at one end of network or at both ends if master is located between slaves (see *Network Termination*).
- Master receive line terminated at both ends of network (see *Network Termination*).
- Master transmit and receive lines each biased at one end (see *Network Bias*).
- Ground connection (GND) required between devices.

DIP Switch Settings
for
Full-Duplex RS-485 Network
Master



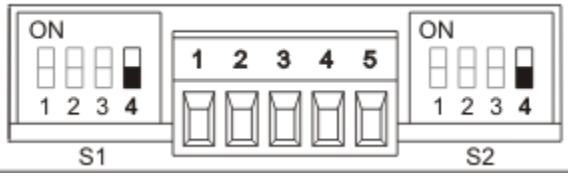
DIP Switch Settings
for
Full-Duplex RS-485 Network
Slave

5.3 Two-Wire (Broadcast) RS-422 Network

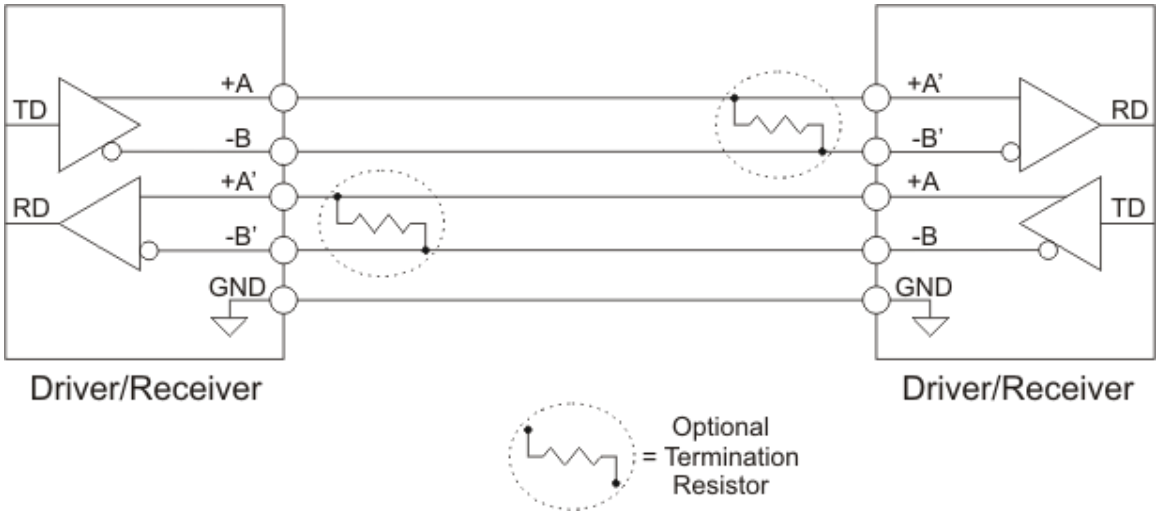


- Twisted pair connection between 1 driver and 1-32 receivers (two wires plus ground).
- Transmitter always enabled.
- Network terminated at receiver located at end of network (see *Network Termination*).
- Line biasing not required.
- Ground connection (GND) required between devices.

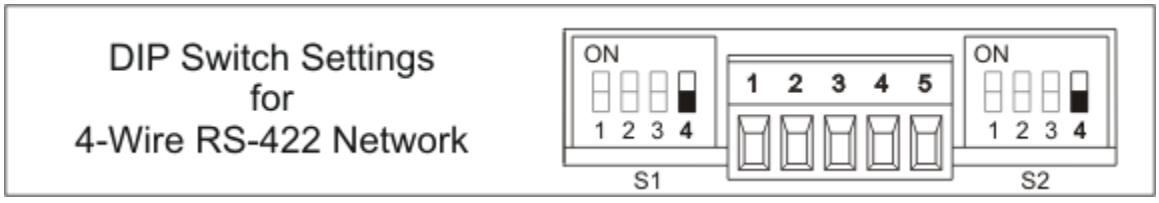
DIP Switch Settings
for
2-Wire RS-422 Network



5.4 Four-Wire (Full Duplex) RS-422 Network



- Twisted pair connection between 1 driver and 1 receiver (four wires plus ground).
- Transmitters always enabled.
- Network terminated at receivers only (see *Network Termination*).
- Line biasing not required.
- Ground connection (GND) required between devices.



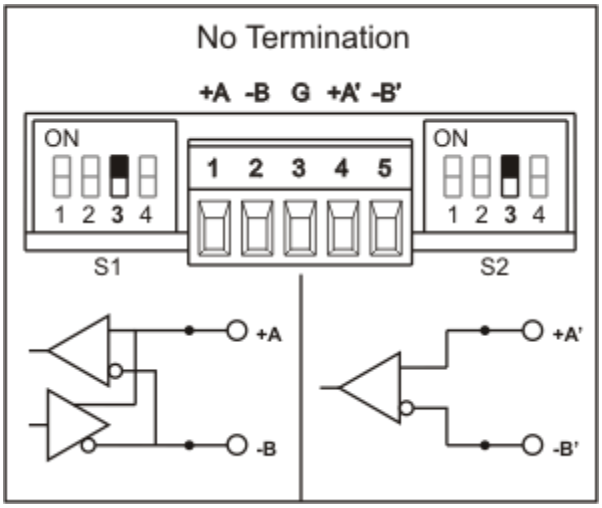
5.5 Network Termination

The BaudMaster™ provides several options for terminating an RS-485 or RS-422 bus. The decision of what kind of termination depends on data rate, cable length and other nodes on the bus.

Terminating resistors are used to prevent transmission line reflections. The type of termination is selected with the DIP switches.

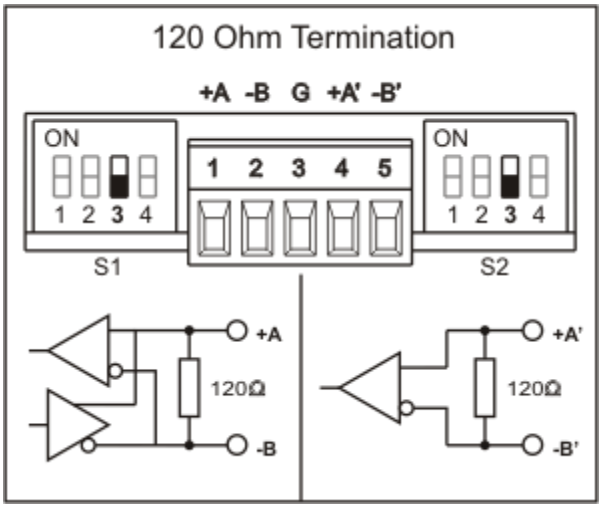
No Termination

- Suitable for slow (9600B / 2000ft) or short (230.4kB / 100ft) networks.
- Low power consumption



120 Ohm Termination

- Required for high baud rate and long distance networks.
- High power consumption



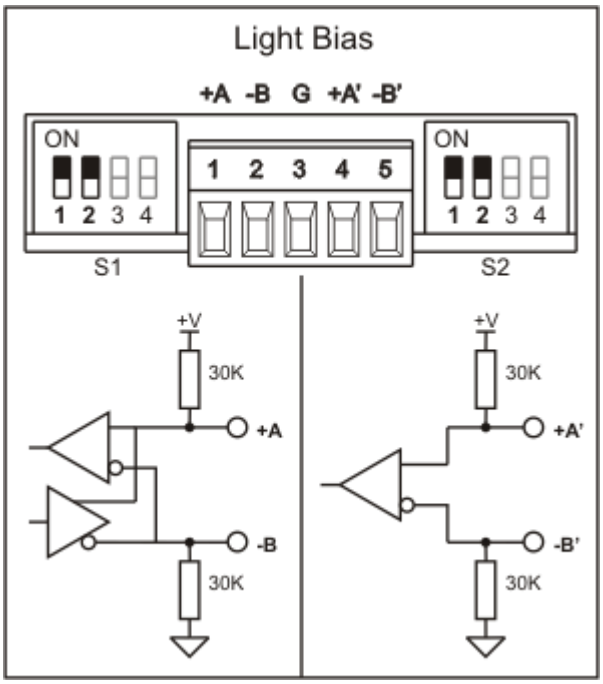
5.6 Network Bias

Bias resistors are used to maintain the proper idle voltage state (200mV across a receiver). There are two bias configurations that are selected with DIP switches.

Light Bias

• Configure light bias for devices installed on un-terminated networks.

• Configure light bias for devices that are NOT providing bias on 120 ohm terminated networks.

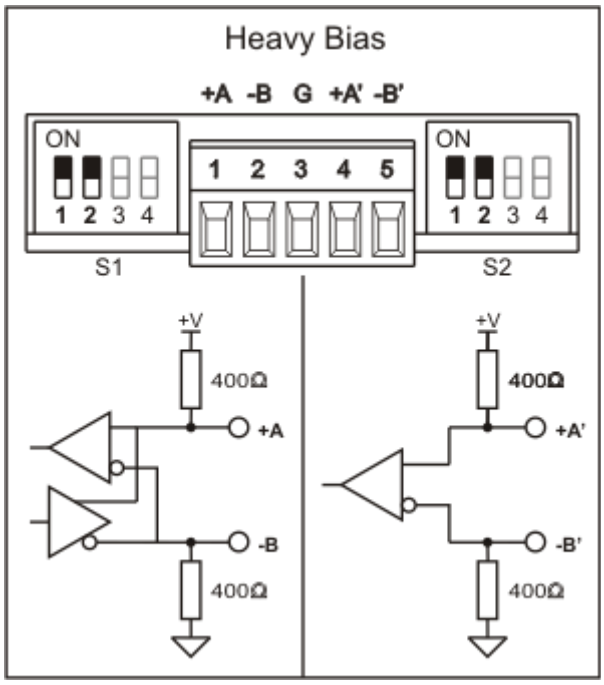


Heavy Bias

• Provides proper idle line voltage level on 120 ohm terminated networks.

• Configure heavy bias at one location on a 120 ohm terminated network, preferably at one end with termination resistor.

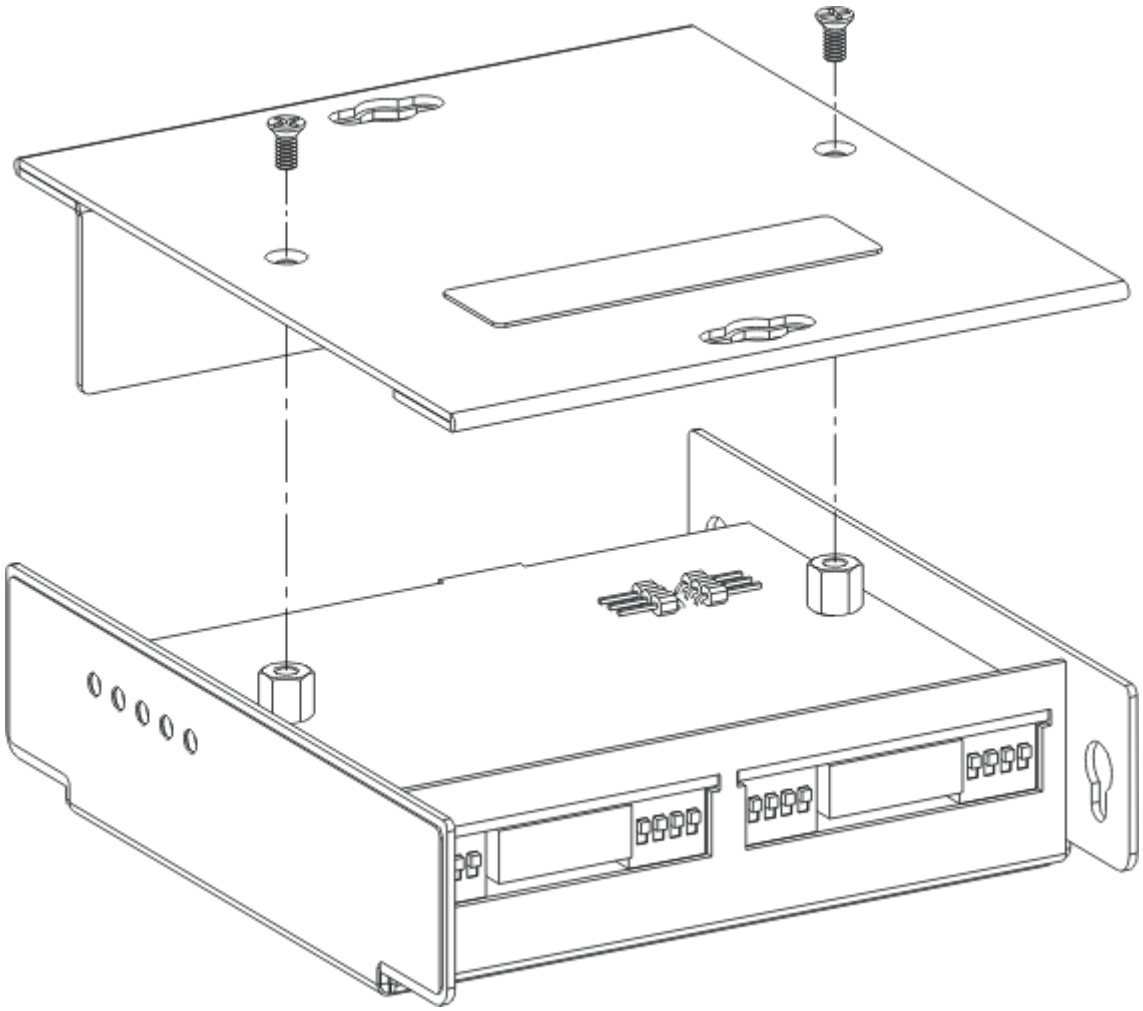
• Increases power consumption.



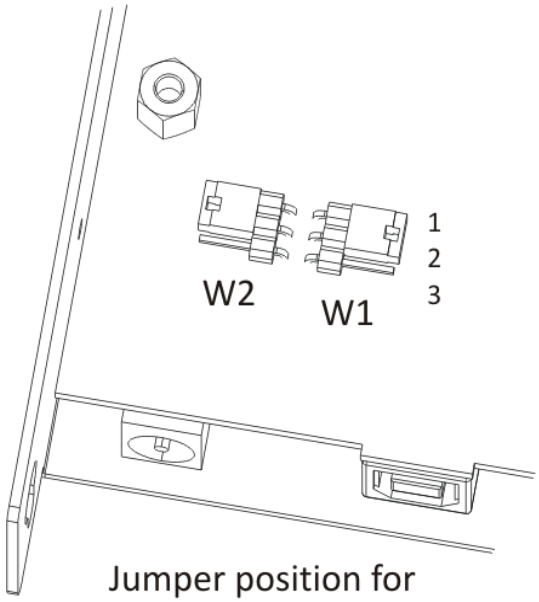
5.7 Power Selection – Dual Port Converter

The dual-port BMUSB converter is a USB high power device (> 100mA) that can be powered directly from the USB host or self-powered hub. For operation with a bus-powered hub (100mA max load per port) the converter can be configured for self-powered operation and use an external 5V supply.

Jumpers W1 and W2 select the mode of operation. To change the configuration, remove the two screws as shown. Remove the stainless steel bottom cover to access the jumpers.

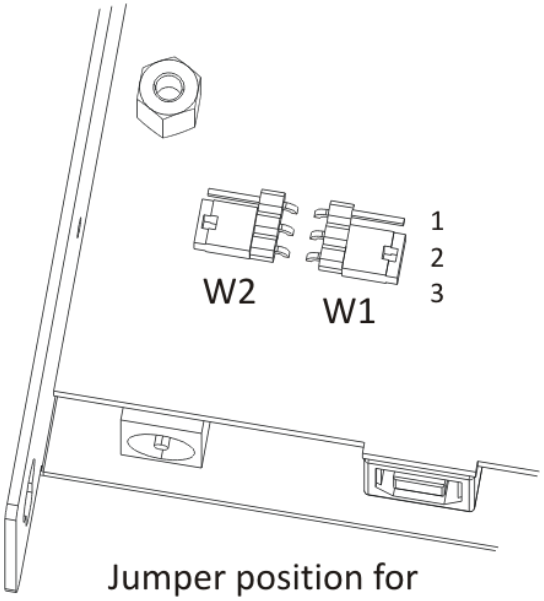


Bus Powered (factory default)
Install jumpers W1 and W2 as shown.
The converter is powered from the USB port and no external power supply is required. This is the preferred configuration for operating the converter with a USB host (PC) or self-powered hub.



Jumper position for
Bus-Powered configuration
W1 1-2 and W2 1-2
(factory default)

Self Powered
Install jumpers W1 and W2 as shown.
The converter draws no more than 100mA from the USB port. The network drivers and receivers are powered from an external 5V supply. This configuration is required when operating the converter with a port-powered hub.

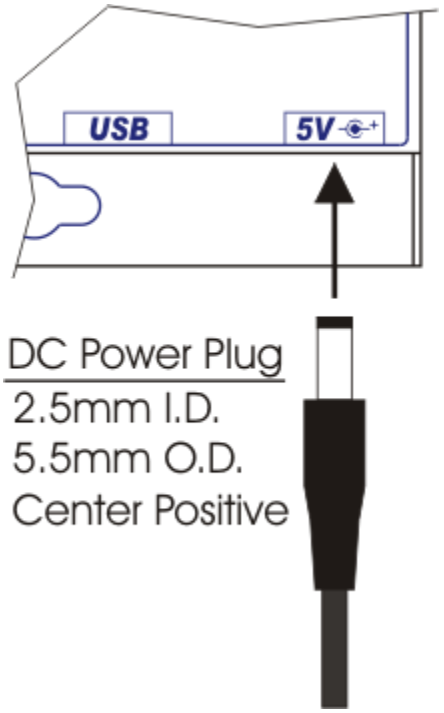


Jumper position for
Self-Powered configuration
W1 2-3 and W2 2-3

Self Powered (cont.)

The self-powered configuration requires an external regulated 5VDC power supply that can provide a minimum of 300mA. A supply with a 120VAC 50-60Hz input is available from Dutec.

Many power supplies use the same barrel-style DC power plug but have different output voltages. To prevent damage from an accidental connection to the wrong supply the BaudMaster™ converter has over-voltage and reverse polarity protection on the 5V power input.



The over-voltage protection will open the connection to the external supply if the voltage exceeds 6.6V. This protection circuit will prevent damage from a connection to a voltage as high as 25V. The reverse polarity protection will short the power input if the polarity is reversed. The short will force the external supply to fold-back and limit the voltage and current. This protection circuit is designed to work with supplies rated for 6W or less.

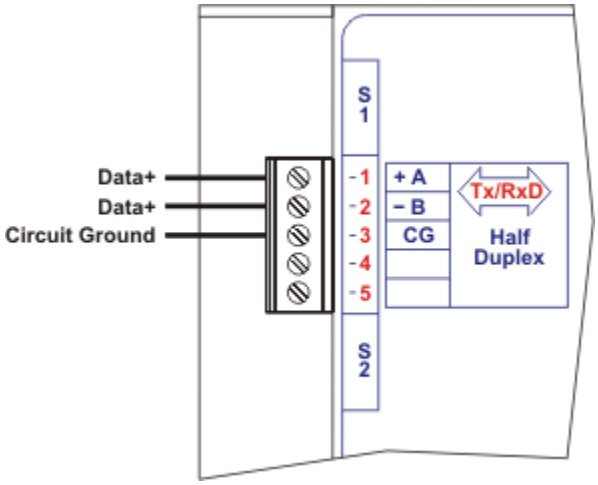
In self-powered mode the I/O Power LED indicates if the external power supply is energized. The LED is ON if the supply is providing 5V and the converter has been enumerated (recognized) by the USB host (PC). The LED will turn OFF if the PC goes into standby mode.

6 Wiring

6.1 Half Duplex Wiring

To connect to a half duplex network install the twisted pair data wires and ground wire as shown.

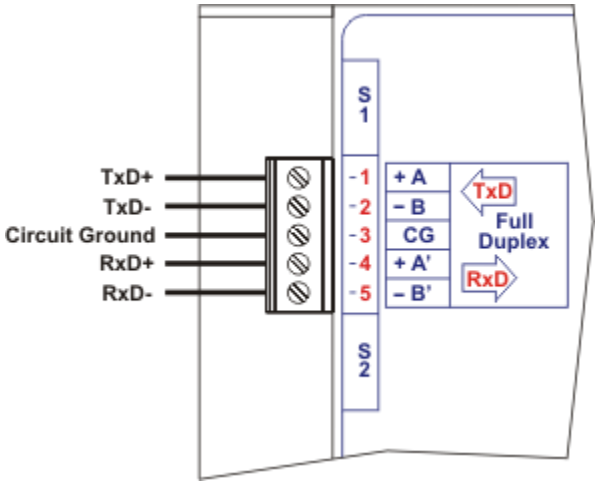
See the *Cable* chapter for recommendations on selecting the appropriate twisted pair cable.



6.2 Full Duplex Wiring

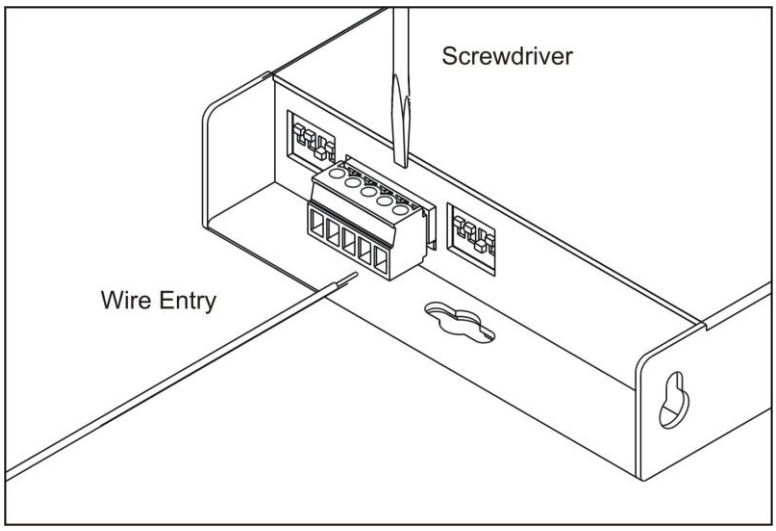
To connect to a full duplex network install the two twisted pairs of data wires and ground wire as shown.

See the *Cable* chapter for recommendations on selecting the appropriate twisted pair cable



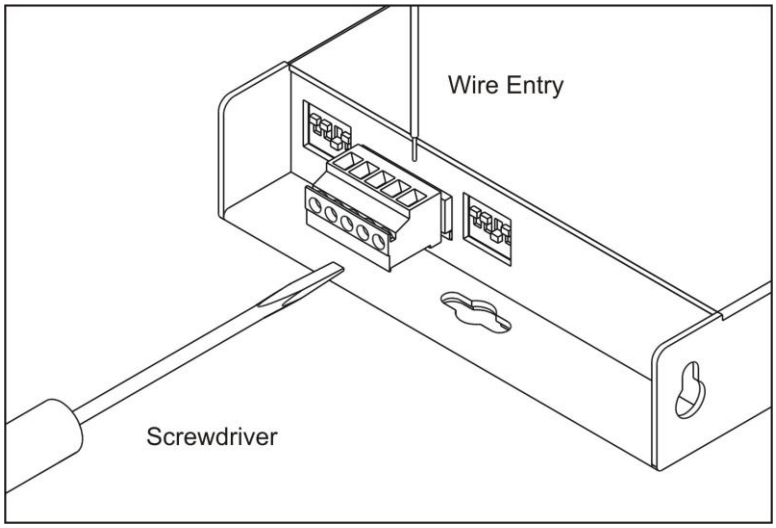
6.3 Termination Plugs

The termination plugs are available in two styles. The parallel style allows the wire to enter the terminals parallel to the unit. This style is standard and probably preferable in most cases.



Parallel Style Termination

The vertical style allows the wire to enter the terminals perpendicular to the unit.

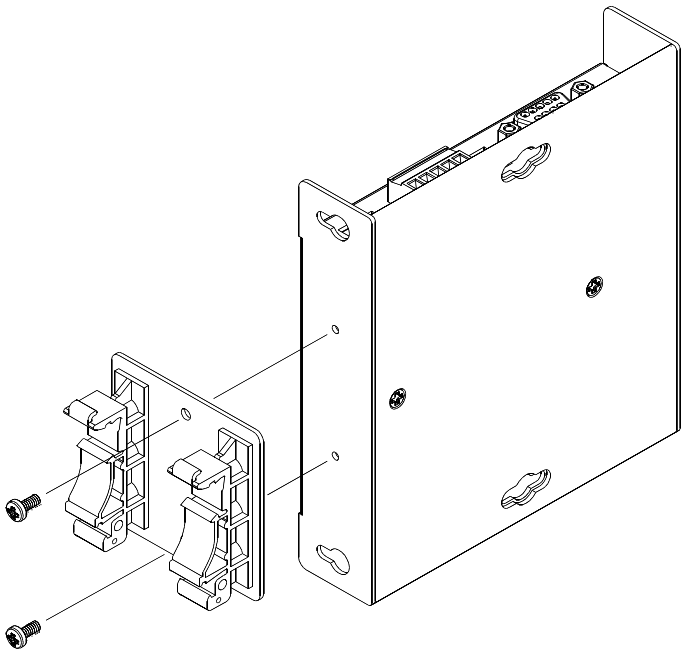


Vertical Style Termination

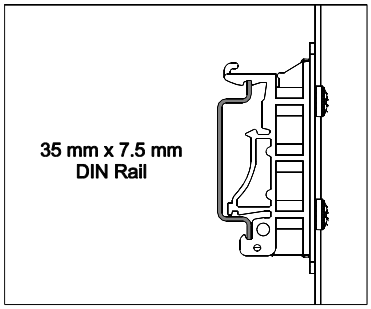
The termination style is specified in the BaudMaster™ order number. See the *Ordering Information* section for more information.

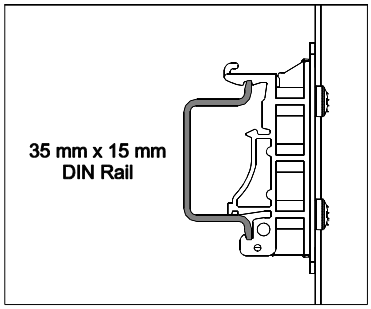
7 DIN Rail Adapter (DA-01)

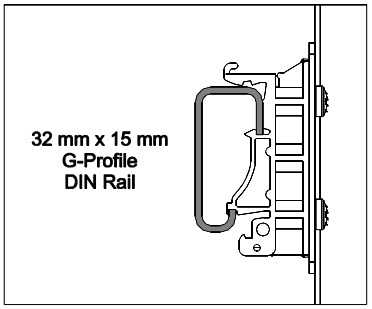
Fasten the optional DA-01 DIN Rail Adapter to the BaudMaster™ with the mounting screws provided.



Mounts to standard DIN rail profiles: 35 mm x 7.5 mm, 35 mm x 15 mm and 32 mm x 15 mm G-profile DIN Rail.







8 Ordering Information

The BaudMaster™ USB to Isolated RS-485/422 converter is available in single port and dual port configurations. See the website at *www.baudmaster.com* or call 800-248-1632 for current pricing.

Model	Isolated 485/422 Ports	Power	Termination Plug
BMUSB-ID1-P	1	Bus – 100mA max.	Parallel Entry
BMUSB-ID1-V	1	Bus – 100mA max.	Vertical Entry
BMUSB-ID2-P	2	Bus – 200mA max. or Self (Ext. Supply)	Parallel Entry
BMUSB-ID2-V	2	Bus – 200mA max. or Self (Ext. Supply)	Vertical Entry

Optional Equipment

Model	Description
DA-01	DIN Rail Adapter (Includes adapter and mounting screws)
BM-PS5	Wall-Plug Adapter, 110-120VAC 50/60Hz Input, 5Vdc 1A Output
BM-PS5U	Wall-Plug Adapter, Universal 90-264VAC 50/60Hz Input, 5Vdc 1.2A Output

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9 Specifications

Isolated USB to RS-485/422 Converters

USB	**Standard**: 1.1 and 2.0 Compliant **Connector:** USB Type B Female w/ High Retention **USB UART:** FTDI Part Number FT232R (www.ftdichip.com)
USB Software (WHQL Certified Drivers)	Windows 7 32 and 64-bit Windows Vista and Vista 64-bit Windows XP and XP 64-bit Windows 2000 Other drivers (Win98, ME, Mac and Linux) available. Contact Dutec for information.
RS-485/422	**Baud Rate:** 183 to 921.6K bps **Drive:** Up to 32 unit loads (1 unit load = 12K ohms) **Range:** 4000 feet (1220 meters) @ 38.4K bps with 24 AWG twisted pair **Connector:** Pluggable Terminal Blocks (#16 to #24 AWG) **Biasing Resistors:** Selectable 30K or 400 ohms to GND and +3.3V **Terminating Resistors:** Selectable NONE or 120 ohms **Network Configurations:** Half-duplex and full-duplex master or slave
Indicators	Receive Data LED, Transmit Data LED, I/O Power (2-port converter only)
Isolation	**RS485/422-to-USB and RS485/422-to-Chassis:** **Hi-Pot:** 2000 V_{RMS} for 1 minute **Leakage Current:** Less than 50uA @ 2000 VAC / 60 Hz
Surge Protection	**ESD Protection to IEC61000-4-2:** +/- 8kV Contact Discharge +/-15kV Air-Gap Discharge +/-15kV Human Body Model
Compliance	Pending (CE, FCC Class A, CUL, UL Safety Class II)
Power	1-port converter (-ID1): USB low-power bus powered device (100ma or less) 2-port converter (-ID2): USB high-power device (200ma max.)
Operating Temperature	-10°C to +70°C
Storage Temperature	-45°C to +100°C
Humidity	5% to 95% RH
Enclosure	18 gage Stainless Steel
Dimensions	Height: 4.60 inches (117mm) Depth: 4.16 inches (106mm) Width: 1.18 inches (30mm)
Weight	Approximately 13 oz. (370 grams)
Accessories	DIN Rail Mounting Kit Wall-Plug Adapter, 110-120VAC Input Wall-Plug Adapter, Universal 90-264VAC Input

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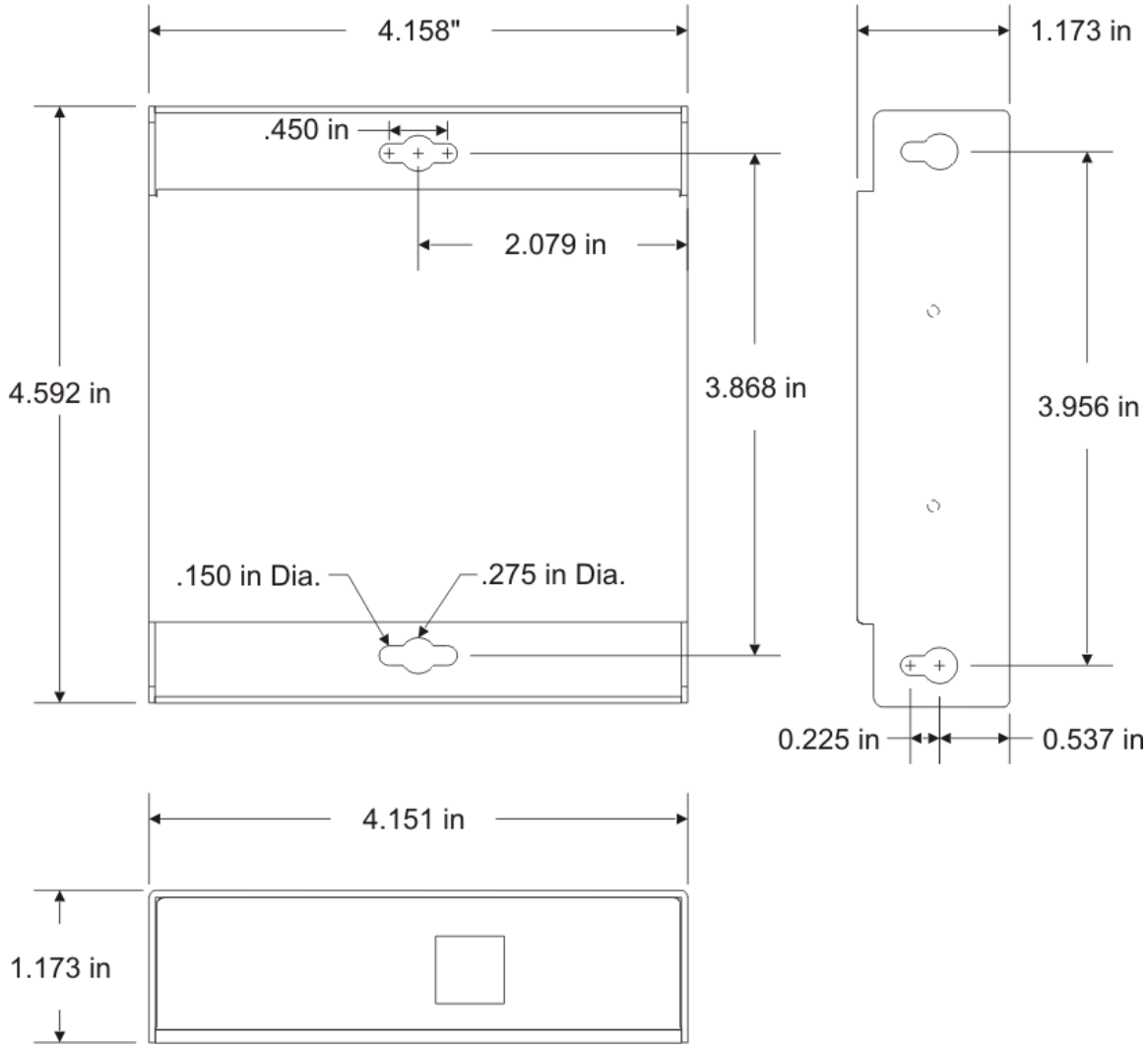
9.1 Dimensions



10 Cable

RS-422 and RS-485 communications requires twisted pair, low capacitance cable, with a nominal impedance of 100-120 ohms. The decision to use shielded cable depends on the application.

RS-422 minimum cable requirements:
Shielded: two twisted pair with drain wire (use drain wire for signal ground)
Unshielded: three twisted pair (using the extra pair for signal ground)

RS-485 minimum cable requirements:
Shielded: one twisted pair with drain wire (use drain wire for signal ground)
Unshielded: two twisted pair (using the extra pair for signal ground)

Belden Shielded RS-422 Cable

Part No.	Wire	D.C. Resistance	Outside Diameter	Impedance	Capacitance	Propagation Velocity
9829	24 AWG (7x32)	24.0 Ω/1000' 78.7 Ω/km	.291 in. 7.39 mm	100 Ω	15.5 pF/ft. 59.1 pF/m	66%
8102	24 AWG (7x32)	24.0 Ω/1000' 78.7 Ω/km	.270 in. 6.86 mm	100 Ω	12.5 pF/ft. 41.0 pF/m	78%
8162	24 AWG (7x32)	24.0 Ω/1000' 78.7 Ω/km	.343 in. 8.71 mm	100 Ω	12.5 pF/ft. 41.0 pF/m	78%
1419A	24 AWG (7x32)	24.0 Ω/1000' 78.7 Ω/km	.248 in. 6.30 mm	100 Ω	13 pF/ft. 42.5 pF/m	78%
9729	24 AWG (7x32)	24.0 Ω/1000' 78.7 Ω/km	.317 in. 8.05 mm	100 Ω	12.5 pF/ft. 41.0 pF/m	78%
9842	24 AWG (7x32)	24.0 Ω/1000' 78.7 Ω/km	.340 in. 8.64 mm	120 Ω	12.8 pF/ft. 42.0 pF/m	66%
88102	24 AWG (7x32)	24.0 Ω/1000' 78.7 Ω/km	.227 in. 5.77 mm	100 Ω	12.95 pF/ft. 42.0 pF/m	78%
89729	24 AWG (7x32)	23.3 Ω/1000' 76.4 Ω/km	.271 in. 6.88 mm	100 Ω	12.5 pF/ft. 41.0 pF/m	78%

Belden Shielded RS-485 Cable

Part No.	Wire	D.C. Resistance	Outside Diameter	Impedance	Capacitance	Propagation Velocity
8132	28 AWG (7x36)	65 Ω/1000' 213 Ω/km	.235 in. 5.97 mm	120 Ω	11.0 pF/ft. 36.1 pF/m	78%
9841	24 AWG (7x32)	24.0 Ω/1000' 78.7 Ω/km	.340 in. 8.64 mm	120 Ω	12.8 pF/ft. 42.0 pF/m	66%

Category 3 (CAT-3) and Category 5 (CAT-5) cables are good choices for unshielded RS-485 and RS-422 cable.